WIRE & WIRE PRODUCTS

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

MORGAN-CONNOR WIRE MACHINES

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The wire was furnished by The Colorado Fuel and Iron Company of Denver and drawn on Morgan-Connor wire machines.

MORGAN CONSTRUCTION COMPANY, Worcester, Mass., U. S. A. MALMEDIE & COMPANY, Dusseldorf, Germany Sole Licensee for Morgan-Connor Wire Machines in Europe

MORGAN WORCESTER

ENGINEERS AND MANUFACTURERS

ROLLING MILLS GAS PRODUCERS WIRE MACHINERY
COMBUSTION CONTROLS

April 1932

ANNOUNCEMENT

THE Firth-Sterling Steel Company has purchased the McKeesport Branch of the Detroit Wire Die Company. This plant has been devoted to the development and manufacture of the new Firthaloy Cemented Carbide drawing and extrusion dies and mandrels.

Under Firth-Sterling ownership this unit continues the manufacture of cemented carbide dies and mandrels and is known as: Firthaloy Division, Firth-Sterling Steel Company.

The Firthaloy Division is under the supervision of Mr. A. R. Zapp, who recently joined the Firth-Sterling Steel Company. He possesses an extensive background of experience in engineering fields, particularly with reference to drawing and extrusion processes.

Mr. Zapp is best known for his work in the development of cemented carbide dies and mandrels, with which activity he has been identified since these new materials were introduced for drawing purposes.

FIRTH-STERLING STEEL COMPANY

WORKS: McKEESPORT, PA.
NEW YORK CHICAGO
HARTFORD CLEVELAND
DETROIT LOS ANGELES
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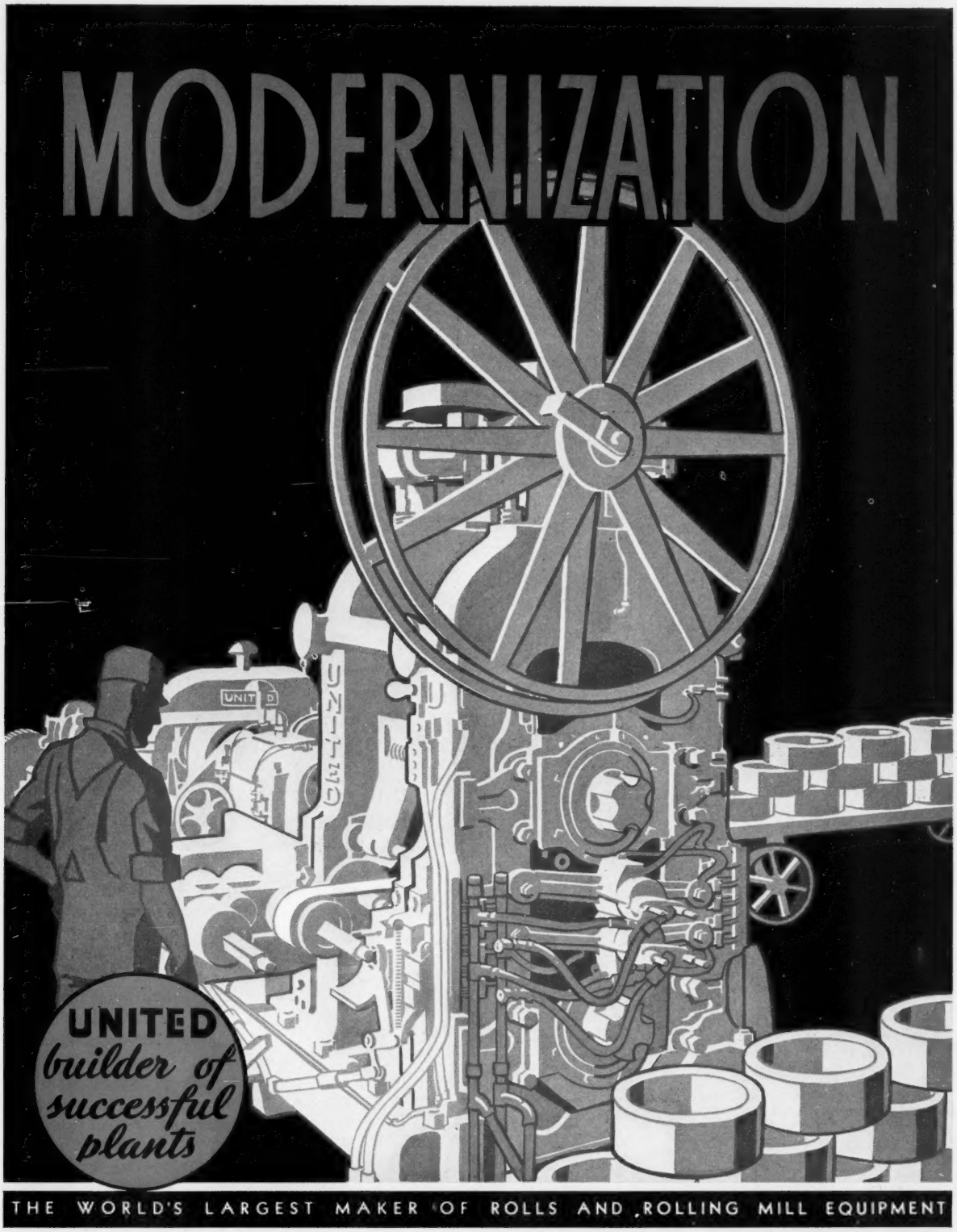

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1932
MEETING and EXHIBITION

Will Be Held at Buffalo, N. Y.

October 3, 4, 5, 6, 7 (incl.), 1932

IN ASSOCIATION WITH THE

NATIONAL METAL CONGRESS AND NATIONAL METAL EXPOSITION

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American Welding Society
Institute of Metals Division, A. I. M. E.

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Iron & Steel Division, A. I. M. E.
Iron & Steel Division, A. S. M. E.
Wire Association

▲ ▲ ▲

Production Activity, S. A. E.
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Wire Association Technical Meetings

A diversified program of papers prepared and delivered by experts—plant operators, engineers and executives from all divisions of the wire industry will be presented on October 4, 5, 6 and 7. There will be separate sessions relating to the production of steel rod and wire; the production of non-ferrous rod and wire; the manufacture of covered wire and cable and the fabrication of wire products. An open discussion will be held on all papers presented. Members are invited to send suggestions for subjects to the Program Committee.

Ralph K. Clifford, Gen'l Supt., Continental Steel Corp., Kokomo, Ind., Chairman; Kenneth B. Lewis, Morgan Construction Co., Worcester, Mass.; W. D. Pierson, Secy. Waterbury Farrel Fdry. & Machine Co., Waterbury Conn.; R. E. Brown, Secretary, The Wire Association, R. E. Brown, 551 Fifth Ave., New York, N. Y.

EXPOSITION SPACE COSTS

The cost of space at National Metal Exposition is based at the rate of $1.00 per square foot, on spaces 10 x 20 or larger; $1.25 per square foot for spaces 10 x 10. A small additional charge for corner locations. These charges include complete booth construction, firm signs, general lighting, complete janitor and watchman service.

YOU ARE INVITED TO JOIN THE WIRE ASSOCIATION

THE EXHIBITS

The types of products that will be represented at the Exposition are entirely too numerous to list here. Among them, however, will be exhibits of raw, semi-finished and finished products; alloys; stainless steels, brass, bronze, copper and bearing metals. The latest supplies and equipment for heat-treating with gas, electricity and oil will be shown in actual operation. Welding and cutting apparatus, machinery and accessories will be exhibited. Inspection and testing equipment, forgings, **insulating materials, wire, wire products, wire drawing equipment and accessories,** precision tools and instruments, refractories, abrasives, rust-proofing compounds, and many other products, processes and methods will be shown.

DETAILED INFORMATION FURNISHED ON REQUEST.

The Wire Association

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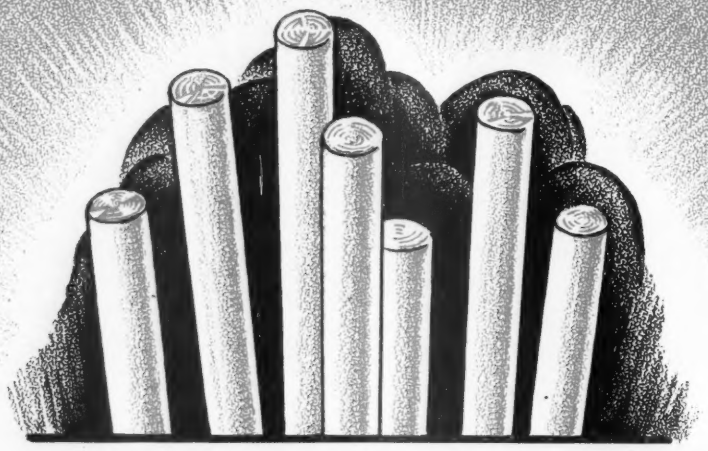

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WIRE & WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip. Wire Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING.

Vol. 7 April 1932 No. 4

Designated as

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The Wire Association 1932 Meeting and Exhibition

Will be held at

Buffalo, New York

During the week of

October 3, 1932

In association with the

Annual National Metal Congress

▼ ▼ ▼

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WIRE & WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip.
Wire Products and Insulated Wire and Cable.
DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 7 APRIL, 1932 No. 4

Fourdrinier Wires and Cloths

By Kurt Jahn, Köditz, Germany

A Research Paper Outlining the Requirements For Fourdrinier Wires and Fourdrinier Cloths. ▼ ▼ ▼

AS a result of details gathered in more than ten years of experience and practice in an industry in which the cloth makers generally have endeavored to keep secret their methods, I present herewith an outline and tabulation of the processes and experiences of the most important European fourdrinier cloth makers in the hope that the data will be of value to all wire manufacturers.

✦ ✦ ✦

THIS first article published in two parts contains details of the various types of fourdrinier cloths, their specialties (with 14 illustrations) and how they are manufactured, their classification, the use of the different types of fourdrinier cloths, the cylinder and special cloths, together with a table showing the different types of fourdrinier cloths which are best suited for the various kinds of paper manufacture.

✦ ✦ ✦

THE second article published in two parts will give details of the kinds of wires used, the selection of the warp and filler wires, exact data about the strains to which these wires are subjected and the best metal alloys used for the warp and filler wires; tables showing wire sizes used for the various meshes and details of winding the wire on warp spools and filler pirns.

✦ ✦ ✦

*Translator's Note

PAPER manufacture in Germany and America appears to have developed on different lines. American mills as a rule use a plain weave for the Fourdrinier fabric, securing such markings and special finishes as are required by impressions from the Dandy roll, and subsequent processing. In Germany such finishes are secured largely through special weaves in the Fourdrinier wires. For the various special weaves there are among our mills no common equivalent terms and the translator has been forced to do some guessing, and perhaps to coin one or two descriptive terms. One departure will be noted by experts. The endless woven wire belt onto which the paper stock flows, and through whose meshes the excess liquid drains away, is known in the paper mills simply as "the wire". As this series of articles deals not only with the woven fabric but with the wire of which it is woven, to stick to this term would confuse both expert and layman. The translator has taken the liberty of referring to this detail as the "belt" or the "Fourdrinier fabric."

* Translated by Kenneth B. Lewis.

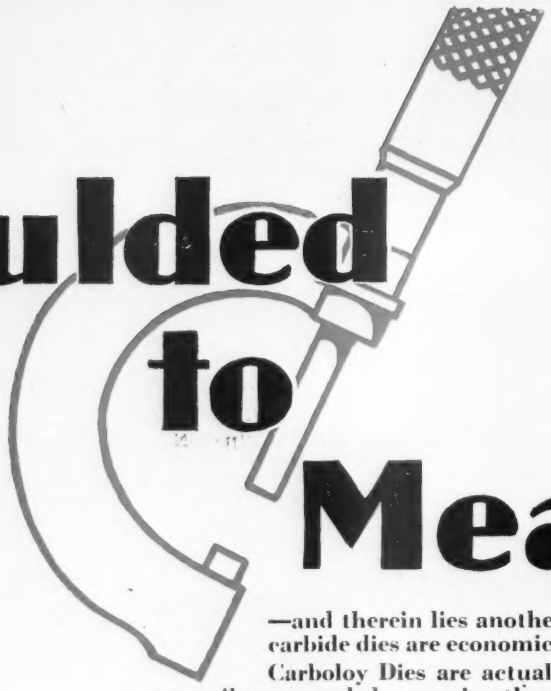
Sec. I—The Belt or "Wire"

IN the weaving of Fourdrinier belts the wires used are chiefly of the copper alloys, phosphor bronze, brass, Tombak, or monel metal. In certain cases the wires are tinned or coated with lead to make them resistant to the chemical influences at work in the paper machine. As in the case of ordinary wire cloth, these Fourdrinier belts are made up in various weaves. The following are recognized:

Plain flat weave	Fig.	1
Twill weave	"	2
Triple twill weave	"	3
Single cable weave, left lay	"	4
Single cable weave, alternate right and left lay	"	5
Double cable weave	"	6

Designated as Official Publication by the Wire Association

Moulded to Measure



—and therein lies another reason why Carboloy cemented carbide dies are economical for the user.

Carboloy Dies are actually "moulded to measure." The raw nibs are made by pressing the powdered metal into steel moulds with steel plungers which *form the shape of the hole to be finished.* After moulding, only a few thousandths must be removed to finish the die to the starting size required.

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1. Uniformity of die shape is assured. All types of dies can be exactly reproduced from the original moulds whenever, and in whatever quantity, desired.
2. Rough nibs in cases may be purchased at a considerable saving and finished by your die man. The technique required is the same as that used for recutting or reworking dies on standard service equipment.

Carboloy raw nibs are manufactured in the United States. The user immediately benefits by each new development in manufacturing technique.

Logical shortcuts to economy such as these are contributing to the general savings being effected by Carboloy Dies in the drawing and extrusion field.

Our representative can outline many interesting and valuable facts about lower conversion costs —less scrap, fewer rejections—and improved quality obtained with Carboloy Dies.

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3. Superior surface finish.
4. Longer life per hole size.
5. Less rejections, less scrap and a more economical product.

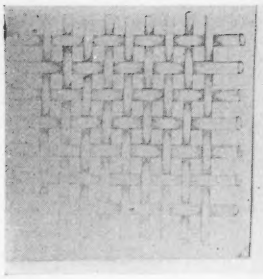

Fig. 1.

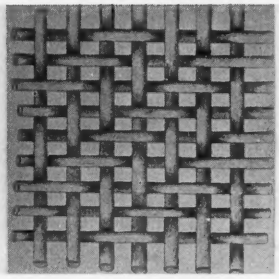

Fig. 2.

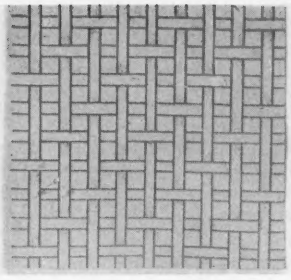

Fig. 3.

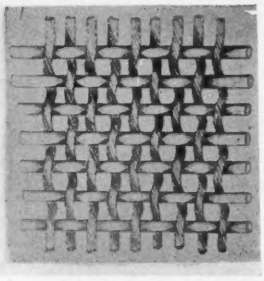

Fig. 4.

Velvet cable weave ..... " 7
Basket weave ..... " 8
Twill basket weave ..... " 9
Flat double warp ..... " 10
Crossed double warp ..... " 11
Triple warp ..... " 12
Thatch laid ..... " 13
Vellum laid ..... " 14

✦ ✦ ✦

Plain Flat Weave

THE plain flat weave shown in fig. 1 is in most common use. In the cable weave the individual wires are replaced by small strands, each strand being composed of 5 or 6 wires stranded around a core of wire or fibre of the same size. For a long time it was believed that the fibre core was better because the strand wires bedded themselves into it and made a firmer structure. In operation however such strands do not stay round, but are deformed, due to the softness of the core, and by the stresses and shocks involved in weaving. Moreover the fibre core lacks the tenacity of a wire core, and the latter is now preferred. The choice between 5 and 6 outer strand wires depends on the tenacity required in the strands.

✦ ✦ ✦

Testing Belts

In testing a cable-woven belt, whether of single or double cable weave, it is noted that the warp wires, due to their flexibility in weaving, do not remain parallel to the belt, but are bowed alternately to the right and the left. The meshes therefore, although of uniform length, are alternately narrow and wide (Fig. 4) This would be scarcely noticeable in a narrow mesh, but in a coarse weave it would prevent uniform draining. To avoid such a difficulty the strands of a coarse mesh cable weave are of alternate right and left twist. The meshes of such a fabric, although slightly offset, are of exactly uniform size. (Fig. 5).

✦ ✦ ✦

The Twill Weave

THE twill weave, (Fig. 2) is not symmetrical. This weave has a tendency toward a diagonal lengthening with a consequent change in the mesh, as a result of which it would appear to be of little value. However it has advantages over the simple weave, to which reference will be made later. An effort has been made to develop a new arrangement which while preserving the advantages of the twill weave would remain always symmetrical. Such a weave is the triple twill shown in Fig. 3, and the velvet (Fig. 7). These two weaves are combinations of the simple flat and the twill weave. In the triple twill weave each warp and filler wire runs over its first opposed wire and then under the next two, and so on. Hence this weave has the mechanical properties of the twill, but with a greater diagonal rigidity.

✦ ✦ ✦

The Velvet Weave

IN the velvet weave (Fig. 7) the warp wires run alternately over and under two filler wires, just as in the twill. The filler wires, however, are differently treated. One filler wire goes, as in the case of the twill, over and under 2 warp wires, but the next is woven as in the case of the simple weave, over and under one warp wire at a time. This weave insures symmetry, for the reason that two adjacent warp wires have a tendency to develop a diagonal pull to the left and the next two to the right, when the strain comes on them. The diagonal stresses are balanced, and the belt stays flat under any kind of strain.

✦ ✦ ✦

The Thatch Weave

THE thatch weave (Fig. 13) is designed to bring out in the paper the appearance of water-

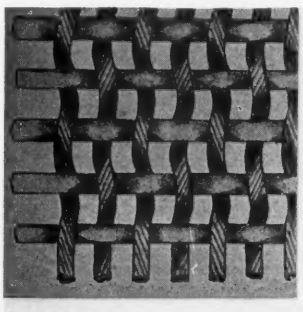

Fig. 5.

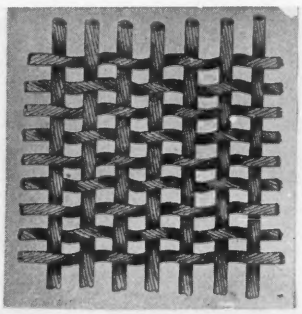

Fig. 6.

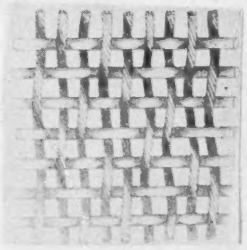

Fig. 7.

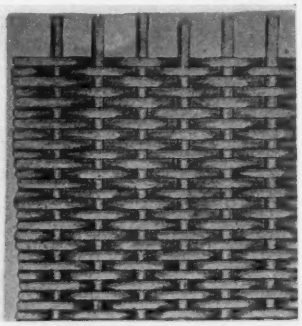

Fig. 8.

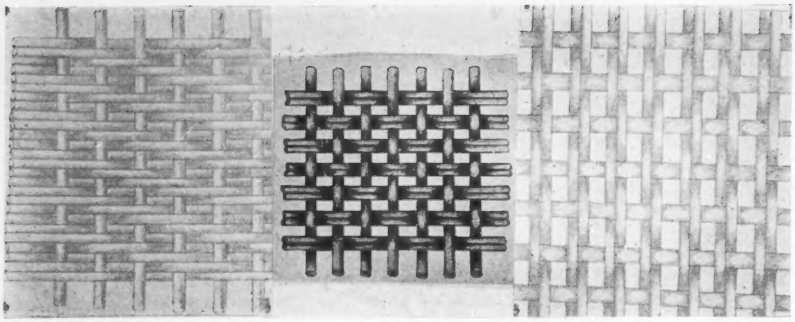

Fig. 9. Fig. 10. Fig. 11.

marked lines, a characteristic of "laid" papers. A laid paper shows, on a spacing of ½ to 1 inch, a series of plainly visible lines called "chains". At right angles to them run a large number of less conspicuous lines, called "ladders". The spacing between ladders is the same as the ladder width.

In this weave the chain is formed of two wires close together, spiralled around each other, and enclosing a filler wire at each half turn. The shorter the spacing between chain wires, the smaller and closer spaced are the ladders.

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The Vellum Laid Weave

THE vellum laid weave (Fig. 14) is a simple flat weave, with the warp wires very fine in comparison with the filler wires. On a spacing of one inch, there are substituted for two warp wires two larger wires of nearly the same gauge as is used in the filler, so close together as to leave no mesh opening. This gives this weave the appearance of the thatch weave (Fig. 13), except that the heavier wires that make up the chain are not twisted but parallel and between them are fine wires on the same spacing as the filler wires.

Sec. II—Classifying the Fourdriniers by Number

IN the foregoing account the belts are classed by the type of weave. Each of these weaves may be made in various spacings according to its purpose. The mesh size determines the "number" of the weave, and is expressed in terms of the number of spaces enclosed between warp wires in one inch of width. In this connection the following standard inches are recognized:

Rheinland inch	**26**	**millimeters**
English inch	**25.4**	**"**
French inch	**27.78**	**"**
Vienna inch	**26.3**	**"**
Old Austrian inch	**26**	**"**
Paris inch	**27**	**"**
"Medium" inch	**27.5**	**"**

This last is in general use in France.

Some leading manufacturers have recently gone over to the practice of numbering in centimeters, but this practise is not yet firmly established.

✦ ✦ ✦

AS stated, the number of a weave signifies the number of meshes in an inch of warp, and this is sufficient for the simple, cable, twell, triple twill and velvet weaves. They are distinguished as simple weave No. 65, cable weave No. 28, etc. On the other hand double and triple warp fabrics are distinguished first by the number of meshes and then by the number of warp wires, as for instance "plain double warp No. 55-100", or "triple warp No. 60-180".

Formerly it was not customary to count the filler wires, except for such fabrics as sieves, window screens, etc, which are always of square mesh. In Fourdrinier belts, however the meshes are seldom square. As a rule there are more warp than filler wires to the inch. In practise the filler wires number about 65 to 80% of the warp wires, and on this account are always somewhat coarser.

✦ ✦ ✦

THE number of filler wires depends upon their size, and this in turn depends on the required stiffness of the fabric; so the number and size of the wires can vary through a wide range for the same weave and number.

In the double warp and the triple warp wave the warp wires are of course smaller than the filler wires, as well as in the case of both thatch weaves, but on the other hand, in the basket weave the filler wire is considerably finer than the warp. The basket is an exception to the general numbering scheme, as in its case the number of the filler wires is also given. For example, basket weave No. 18-110" means 18 warp and 110 means 18 filler wires per inch.

In the case of thatch weave the spacing of the chain is given in millimeters and the number of filler wires per inch, as for example: "thatch weave 26 m. m. 28 fillers".

✦ ✦ ✦

Sec. III —Application of the Different Fabrics

THE raw material for the various grades of paper is of course prepared in various ways. The fibres vary in length and thickness, and the materials undergo different treatments. For the various grades, from tissue to straw-board, there are required

(*Please turn to page 127*)

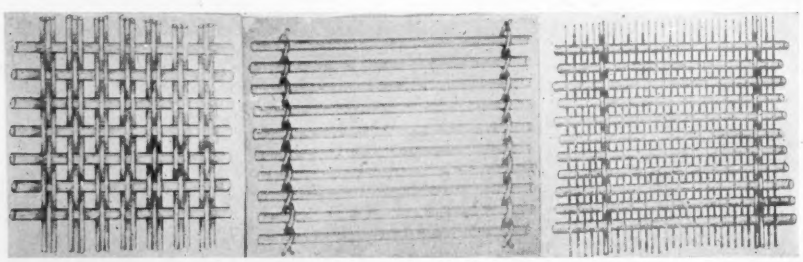

Fig. 12. Fig. 13. Fig. 14.

Gauge Mesh and Weave for Various Papers

	Cable	Double Cable	Velvet Cable	Cable Tinned	Plain	Double Warp	Triple Warp
Drainers							
Drainers, non corrosive stock	20						
" " " "	25	25					
" " " "	28	28					
" " " "	30						
" " " "			40				
Drainers, corrosive stock				28			
" " "				30			
Boards and Cartons							
News board	20						
Carton—asbestos	25						
Jacquard board	35						
Binder board	40						
Light board	45						
Manila for book covers					60		
Carton (cylinder machine)	60						
Wrapping Papers							
Sugar and bag papers	30						
Straw board—corrugated	35						
Butcher fibre	40						
Parchment—Kraft	50						
Light straw—tissue							35/105
Medium wrapping							40/120
Wrapping, parchment, copy (New Zealand Flax)					70		
Thin wrapping						45/90	
" "							45/135
Tissue							60/180
Newsprint							
Newsprint					65		
"					70		
"					75		
"					80		
Smooth Newsprint						55/110	
Writing and Print Papers							
Print paper					65		
Writing paper—proof paper					70		
Book—parchment					75		
Fine white					80		
Writing, fine print						50/100	
" " "							50/150
" " "					85		
Thin print					90		
" "					95		
Very thin, Bible paper					100		
Thin Varieties							
Tissue						55/110	
Tissue from pure rag stock							55/165
Tissue (muslin)						60/120	
Thin envelope paper—cigarette paper							60/180
Cigarette paper							65/195
Cigarette paper, thin opaque							70/210
Miscellaneous							
Tar paper	28						
Colored sheets for duplex wrappers					40		
Washing cylinders					45		
" "					55		
Cylinder wire (carton stock)					50		
" " " "					60		
" " for wall papers					65		
Photographic papers					80		
Filter paper					100		
" "			(vellum laid weave)				

Electrical Characteristics of Rubber Insulation

By E. W. Davis and G. J. Crowdes, Assistant Electrical Engineers,
Simplex Wire & Cable Company, Boston, Mass.

SYNOPSIS

This paper deals with the properties of rubber compounds with particular reference to the effect of such properties on the electrical characteristics of a rubber insulated wire or cable in service.

The properties of rubber compounds which affect the electrical characteristics of a wire or cable are listed, and the recent improvements made in each and their contribution to the service life of a wire or cable are discussed.

For each particular type of service there are certain properties which must not change appreciably. From this point of view there have been shown the tremendous improvements made in the electrical characteristics of rubber compounds. The fact that such improvements are accompanied by equally great advances in the physical properties of compounds assures a greater service life for wire or cable than ever before attained.

The great advantage that rubber compounds may be varied by compounding to fit each particular kind of electrical service is brought out and the extreme importance of so doing is emphasized.

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Properties of Rubber Compounds which Affect Electrical Characteristics of Wire or Cable and Recent Improvements Made in Each are Discussed. A Paper Presented Before the A. S. T. M. Published in Two Parts ▼ ▼ ▼ ▼ ▼

IN this paper are discussed the properties of rubber compounds with particular reference to the effect of such properties on the electrical characteristics of a rubber insulated wire or cable in service.

This paper in a certain measure supplements one presented by C. R. Boggs[2] before the Signal Section of the American Railway Association in which was given a rather complete discussion of the salient developments in modern rubber compounding with particular reference to the improved physical and aging characteristics.

Since 1880, when rubber insulation was first manufactured on a practical basis, the field for its use has undoubtedly been larger and more varied than for any other type of insulation. Developments and improvements in the art of compounding rubber have been many and important—and due to these advances primarily, new and larger opportunities are developing every day.

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Properties Affecting Electrical Characteristics of Wire or Cable

The properties of rubber compounds which affect the electrical characteristics of a wire or cable so insulated may be listed as follows:

1. Insulation Resistance.
2. Dielectric Strength.
3. Specific Inductive Capacity (Dielectric Constant).
4. Power Factor.
5. Permanence or Life.
6. Water Absorption.

The first four of these properties are strictly electrical while the fifth and sixth are physical properties. But since the resistance to water absorption and life of a rubber compound may control the electrical characteristics of a cable over a period of years in service, these properties should also be considered in this paper.

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Insulation Resistance

IT has long been recognized that the term "insulator" is only a relative one, since all known materials pass some current, however slight, when subjected to voltage stress. The true make-up of this leakage current is not known but it is probably quite complex, being in part ionic and electronic, and, due to the presence of small amounts of impurities, it varies considerably throughout the material considered.

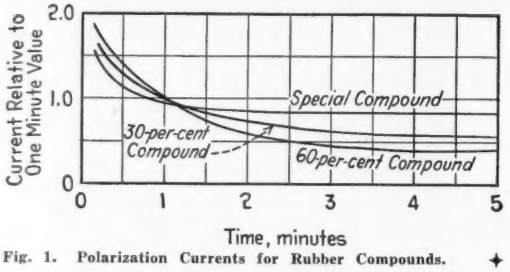

Fig. 1. Polarization Currents for Rubber Compounds. ✦

Students of dielectric behavior are familiar with the variation of current with applied voltage and time. Upon initial application of voltage a relatively large current flows which gradually decreases to a final current of small magnitude. Figure 1 gives three typical curves for compounds of varying rubber content.

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SUCH curves when analyzed indicate that the total currents are made up of three parts. The first and largest constituent is a polarization current, of short duration, which results from the displacement of bound electrons in the di-electric. The second part and one of extreme practical importance is a reversible charge of long relaxation time, mainly ionic in nature. The third component is the true irreversible conductive

[2] C. R. Boggs, "Modern Progress in Rubber Compounding," presented before the Signal Section of the American Railway Association in New York City, 1931.

current which continues after the first two components have vanished.

Rubber compounds, like all dielectrics, hold a charge and upon discharge exhibit a current decaying with time, the first part of which is mainly the displacement current, and the latter part a current due to the reversible charge, which finally dies away to zero. Figure 2 shows the relation of typical charge and discharge current to time for a commercial rubber compound.

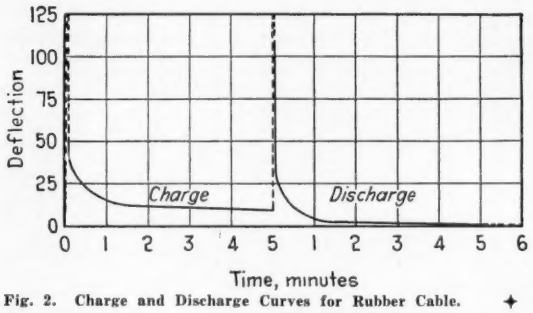

Fig. 2. Charge and Discharge Curves for Rubber Cable.

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INSULATION resistance as indicated by the "charging current" is a quantity which varies with the time of electrification and the voltage. Standard commercial practice calls for a time of electrification of one minute at a voltage between 100 and 500 volts and a standard reference temperature of 60° F. (15.5° C.). Since insulation resistance as commercially required is an arbitrary figure, it is not surprising to find that it is not a direct measure of the quality of the insulation nor is it a guarantee of successful performance in service. It is rather a useful measure of the uniformity and of the mechanical soundness of the insulation of wire or cable. Extremely high insulation resistance in a cable means very little as to serviceability. It is of greater importance to have a moderate value, so long as it changes little in service.

The insulation resistance of rubber compounds like that of most insulating materials changes with temperature decreasing as the temperature increases. In Fig. 3 are shown typical curves which illustrate the relation between insulation resistance and temperature for three different grade compounds. From such curves temperature coefficients are obtained and all readings corrected to the standard reference temperature.

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IN Fig. 4 is shown the relation of D. C. and the A. C. insulation resistance to the temperature of a rubber insulated wire. The D. C. insulation resistance in Fig. 4 falls off rapidly with temperature while the A. C. is comparatively unaffected. Since this particular wire was to be used on fairly high A. C. voltage it is evident that the D. C. insulation resistance means very little from the point of view of predicting the behavior of the wire in service. The A. C. resistance for the above figure was calculated from dielectric loss and power factor tests at 60 cycles.

In properly made rubber compounds the insulation resistance should be unaffected by normal voltage tests. However, when insulation is stressed beyond its electrical "elastic limit" by application of too high voltage the insulation resistance is permanently affected. Table I taken from paper by W. I. Middleton and C. L. Dawes,[1] clearly shows the effect of over voltage. Such tests cause permanent injury and in many cases the wire would be unfit for service.

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Dielectric Strength

When voltage is applied to an insulated wire or cable, the stress upon the insulation is not uniform due to the radial field, but varies from a maximum at the conductor surface to a minimum at the outside. Commercial practice has been to specify the dielectric strength of insulation surrounding a cable in terms of either the maximum stress at the conductor surface or the average stress throughout the insulation. The latter method is suitable for the average cable but is distinctly not proper for thick insulation in which the ratio of outside diameter to conductor diameter exceeds 2.72. In the latter cases, dangerously high stresses may exist at the conductor surface which would not be disclosed by using average stress as a criterion.

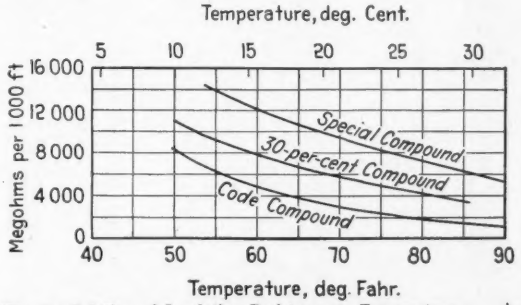

Fig. 3. Relation of Insulation Resistance to Temperature.

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THE object of the factory test is to determine or prove the in-

[1] W. I. Middleton and C. L. Dawes, "Voltage Testing of Cables," **Transactions**, Am. Inst. Electrical Engrs., Vol. XXXIII (1914).

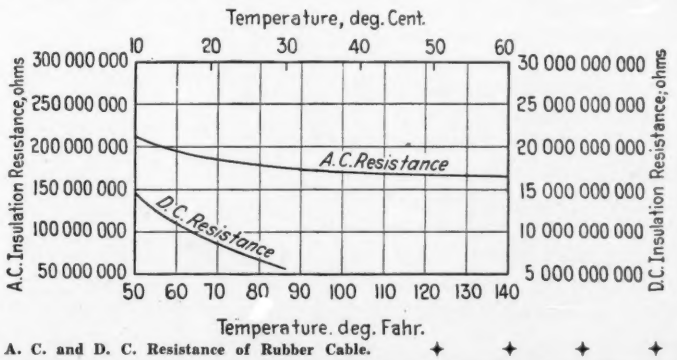

Fig. 4. A. C. and D. C. Resistance of Rubber Cable.

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Table I.—Wires Showing Results of Stress.
Values given are in megohms per 1000 ft.

Test	Length, feet	Before Voltage	After 2500 Volts, 1 minute	After 5000 Volts, 1 minute	After 2 hours rest	After 5000 Volts, 5 minutes	After 2 hours rest
No. 1	1562	14,500	14,500	7,500	11,500	....	....
No. 2	1547	22,000	22,000	16,000	18,000	....	....
No. 3	3150	7,500	7,500	6,000	7,000	5000	5000
No. 4	1740	15,000	15,000	6,500	10,000	750	2500
No. 5	2402	15,000	15,000	7,500	10,000	2500	3500

Table II.—Physical and Electrical Deterioration of a Rubber Compound.

Property	Original Value	Present Value After 30 Years in Service	Depreciation, per cent	
Tensile Strength	1000 lb.	670 lb.	33	Average,
Elongation to Break	9 in.	3½ in.	83.9	58.5
Insulation Resistance	387 megohm-miles	302 Megohm-miles	22	Average,
Voltage Breakdown	500 volts per mil	287 volts per mil	42.5	32.25

tegrity and quality of the insulation without being so severe as to cause permanent injury to the insulation. With this point in view a thorough knowledge of the stresses existing at the test voltage is necessary. In setting voltage tests for various wires both the amount and duration of the voltage should be considered. In this country, one to five-minute tests at relatively high voltages are quite common, while foreign practice is to use lower voltages for longer times. In general for the products and conditions of this country the higher voltage tests at shorter times are preferable, since it has been found that such tests will disclose weaknesses not evident at lower stresses. However, it is necessary to keep the voltage values well up if the shorter tests are to be of value.

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THE relation of dielectric strength to time is quite well known for paper but not so well known for rubber insulation. The general indication from private investigations is that rubber insulation when properly designed is not affected so much by time of application as is paper or varnished cambric insulation. Another way of stating this is that rubber compounds designed for high-tension service will operate at values of stress much closer to their ultimate breakdown values than other types of insulation.

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FIGURE 5 shows data on the relation of dielectric strength to time for a rubber insulated cable and impregnated paper cable of the solid type. The higher index of the curve for the rubber cable is apparent.

THE data given in Table II for a rubber compound made long before the day of organic accelerators and anti-oxidants bring out the close connection between physical deterioration and electrical deterioration. Manifestly, modern compounds using accelerators and antioxidants in which physical deterioration is reduced to extremely low values, must also deteriorate much less in dielectric strength in service.

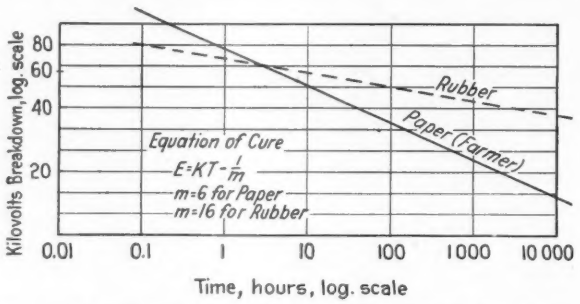

Fig. 5. Voltage—Time Characteristics of Paper Compared with Rubber Cable.

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Varying opinions have existed for many years as to the proper method of stress calculation in cables. Probably a large part of the disagreement has been due to the inherent non-uniformity of insulation. Breakdown tests show a surprising variation and it is practically impossible to prove that any one method is correct. Indications are that the mechanism of breakdown, at least in its final states, is of a thermal nature, but that in any event, the process is quite complicated and some variation must be expected.

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IN Figure 6 is shown a comparison of dielectric strength to cure for three different rubber compounds. Compound No. 1 is an old compound made before the days of accelerators and anti-oxidants and its dielectric strength shows a pronounced maximum at or near the proper cure from the physical standpoint. Compounds No. 2 and No. 3 are modern compounds using accelerators and anti-oxidants. Their dielectric strengths are much less affected by time of curing and, incidentally are greater in value.

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Electrostatic Capacity and Dielectric Constant

Like all dielectrics, rubber compounds when subjected to a voltage stress retain an electrical charge. This charge is, to a large extent, due to the work done in distorting the molecules of the material, and is known as the true geometric or displacement charge. In addition, such work as is done in the rotation of dipolar molecules, if present, adds to the displacement charge. The capacitance of the insulation is defined as the ratio of its charge to its potential. When the charge is in coulombs and the potential in volts, the capacitance is given in farads. For practical purposes, however, especially with wire and cable, the farad is too large and a unit one millionth of a farad—the microfarad—is used.

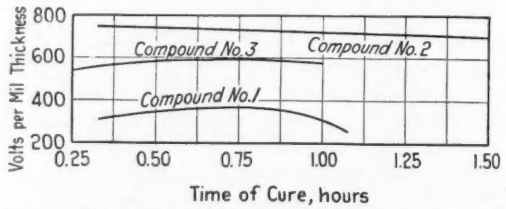

Fig. 6. Relation of Dielectric Strength to Cure.

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(To Be Continued In May Issue)

Safety Practices Increase Rod Mill Efficiency

By R. H. Ferguson, Safety Engineer
National Safety Council

Part II

Suggested Practices for Accident Prevention in Rod Mills * * * Some Ideas which will Reduce the Accident Hazard and Increase the Safety Factor in Rod Production. Part II. ▼ ▼

Rod Rolling Hazards

IN general the hazards associated with the actual rolling of rods may be summarized as follows:

1. **A misdirected rod will penetrate and pass through the body or limb.**
2. **It may loop about the leg or arm and cause such severe burns that amputation may be necessary.**
3. **If it comes in contact with an unprotected portion of the body a serious burn of course results.**
4. **A man may become entangled and drawn against the roll.**
5. **He may be caught and felled.**
6. **In addition to these hazards there are also the characteristics of rapidly moving machinery which of course are not serious where ample guarding has been provided.**

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The "Bull-Dogger"

THE "bull-dogger" is also in a more or less hazardous spot if the billet has not been uniformly heated throughout. When not evenly heated the billet tends to curve toward the cold side. If a cold spot is present the billet may give a decided jerk in that direction. While these are conditions familiar to the experienced operator, they should always be called to the attention of a less experienced man. He should see that the cold side of the billet is on the bottom as it enters the rolls. Suitable goggles should of course be provided to protect such workers against flying scale.

EVERY operator on duty should know when a bar is in the mill, and should know its exact position. Whenever an adjustment is made on the roll which changes the size and shape of the bar, it may alter its course and the catcher should stand in the clear to prevent being hit if the rod should head towards his usual standing place.

A necessary precaution is to see that the intermediate rod is over the "hold back" when it leaves the trough in the direction of the catcher. On one occasion after the "rougher" had adjusted the roll, the bar was diverted from its usual course, and knocked the trough against the man's foot causing a severe injury.

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Alertness Breeds Safety

IT is well to emphasize continually the extent to which safety of the men working on the rolls is due to alertness and their own attentiveness. Signals must be clear and thoroughly understood by all. Noises which might be construed as signals or which might detract the attention of any man from his work should never be permitted. Cat calls, shouting, horseplay, or fooling of any kind should not be tolerated. Where open spaces exist between sets of rolls or finishing mills they should be guarded to prevent a man from stepping into the path of a rod.

Safety Rules Suggested

FROM the experience of many companies the following rules are suggested. If rigidly enforced they will aid materially in the prevention of accidents:

1. **The floor on which rods slide should be kept free of obstructions or any conditions which would tend to deflect the rod from its natural course.**
2. **When passing through a mill a worker or others should always use stairways or runways provided and never step over troughs, looping floors, or repeaters, unless in a direct line of duty.**
3. **Shields or other suitable protection should be in place to protect men who must work between two stands of rolls inside of repeater.**
4. **Employees should be warned of the danger of standing on or walking over a repeater while the mill is in operation.**
5. **Floors should be kept as clean as possible. Scrap should not be allowed to accumulate where it may be caught by running rods. Spare castings, grease, and supplies must not be left on the floor or standing, but be kept in a suitable place.**
6. **Never step or walk over running rods except in case of necessity and then always be on the lookout for striking ends of rods.**
7. **Catchers on the finishing passes should wear efficient metallic reinforced shin guards. The catchers should work outside of the loop when looping passes whenever possible.**

8. **Hot mill operators must avoid being "pocketed" where they cannot escape any dangerous conditions which may arise.**
9. **Flying shear operators or other shear operators must pay strict attention to their job and be on the alert at all times. Horseplay and inattention on this job should never be tolerated because of the seriousness of the hazards involved.**
10. **On continuous mill reheating furnaces the peel bar operators should always stand at the end of the bar and not at the side.**
11. **"Roughers" in rod mills should wear screen faced masks or goggles, preferably of the wire screen type.**
12. **Catcher tongs must be kept free working and in first class condition.**

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WHERE straightening machines are used for hot bars, care should be taken that the dogs on both ends of the machines are in good condition and of proper size to handle the material being run. The machine should be properly guarded as there is a possibility of the dogs slipping and the material flying out.

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Hooking

IN general the hazards of hooking are well known but it is advisable to see that this work is carefully supervised to make sure that workers do not become careless. The man employed for hooking must be alert, conscientious, and energetic. He must not only observe safety precautions for his own account, but should be quick to perceive and correct conditions which may endanger others. Coolheadedness and dexterity are essential qualifications for this job. The hooker should also be given thorough instructions as to the best and most efficient methods of conducting his work. Inattention or incompetency on the part of such a worker not only endangers himself and the catcher, but also contributes materially to the increased scrap and lower production.

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NO floor or guide imperfections should be permitted which would tend to deflect the rod from its course or cause the hooker to trip and fall. Slight imperfections such as unfilled bolt holes, crevices between plates, a protruding bolt or rivet head, a rough spot or lump on the floor plates may cause a rod to jump, loop, or twist with possible serious results. If all obstructions are removed a considerable amount of the hazards will be eliminated. Of course hookers must avoid as far as possible, allowing hooks to be caught in rods. If this should occur prompt warning must be given the catcher so that he can get into the clear.

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Reeling

IT is essential in reeling to see that the ends of the rods are turned into the bundle rather than out. Should the end protrude from the bundle there is a constant source of trouble and cause many minor injuries. In cases where the ends are not properly placed they may catch on the clothing or scratch the arms of men passing or handling them. For these reasons the men attending the work at the reel should be alert, quick, and thoroughly understand their job. It is suggested that the following two rules always be observed in this work:

1. **Make certain that when any repair work is to be done the pass is blocked off and the signal light used.**
2. **To prevent the end of a rod on the reel from hooking, breaking off, flying, or jumping out of the rolls, it is recommended that reels be properly screened off.**

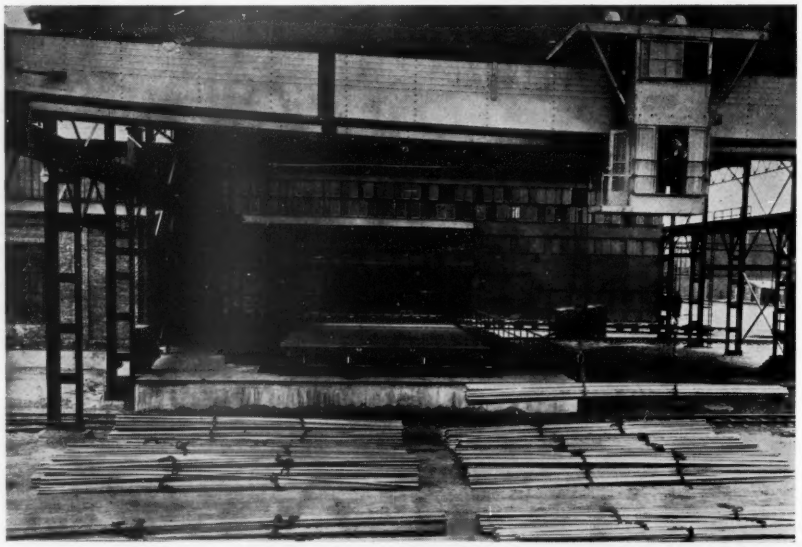

Fig. 7. Crane Handling 30 ft. Billets for Continuous Rod Mill.

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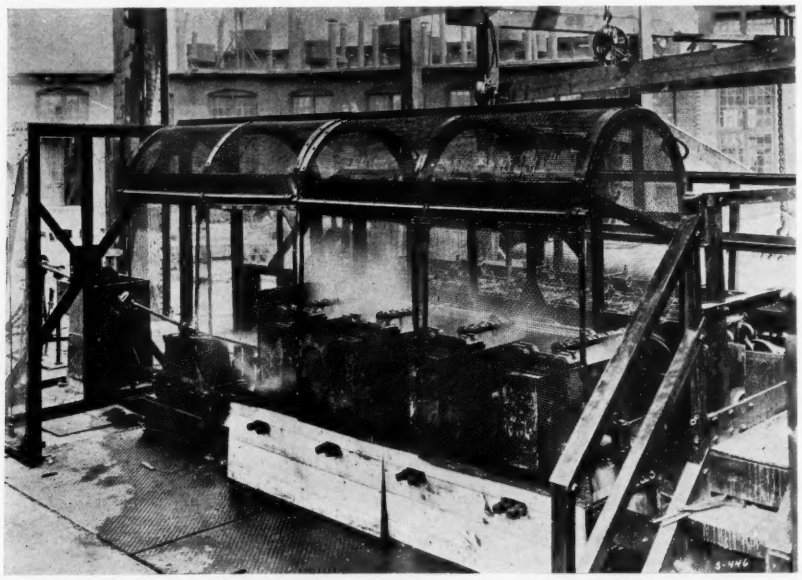
Roll Changing, Adjusting or Repairing Mills

PRECAUTIONS in adjusting or repairing any part of the mill should be continually stressed. There are many conditions to be observed by maintenance men or others making repairs, and often some important matters will be overlooked unless attention is regularly directed toward them. In overzealousness to get the mill running there are occasions where infractions of safety rules may be made unintentionally. Repeated emphases of these instructions cannot fail to lessen infractions of this sort materially. Stretchers for flexible or wobbler couplings should never be bound with wires.

Only canvas or leather straps and tongueless buckles or small ropes should be used.

On making repairs on the mill, the millwright should protect the workmen by locking all switches or valves controlling machinery and he should make sure that the work is completed and all men and tools in the clear before the locks are removed and the equipment returned to service A socket or closed wrench should be used when adjusting rolls unless local conditions prevent.



Finishing Train of Continuous Rod Mill Completely enclosed in Cobble screens. Roll Adjustments can be made from the outside.

Before starting to repair or do any work on reels, the roller should be notified and he should see that the pass is properly blocked and the reel lights are working properly. When changing rolls, bearing boxes must not be allowed to rest on couplings or spindles. They must be placed on the floor and care used in handling these boxes to avoid injury.

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Handling Scrap

A collection and disposal of scrap, which results from the operations of the rod mill, is a problem which should always be thoroughly considered. It is a well known fact that scrap must be carried out of the way so it will not interfere with production. If handled properly and immediately this will prevent a great amount of good steel becoming scrapped. Then too it must be remembered that proper removal will eliminate possible causes of accidents.

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IN the collection and bundling of scrap the following rules should be rigidly observed:

1. **Laborer and scrap man must not go into hazardous parts of the mill to remove scrap or for any other purpose without the consent or knowledge of the foreman or other persons to whom this authority has been delegated.**
2. **Scrap balling machines should be designed to shut down automatically when the control is not manually held in the running position. When the control does not function as described the machine should be immediately shut down until repaired. Operators of these machines should be held responsible for the observance of this rule.**

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OTHER precautions to be followed are: Where a scrap balling machine stands alone, two men should operate it, one handling the control while the other feeds the scrap. Where two machines are located near each other it is permissible to operate the two machines with three men. These machines should always be operated by men who speak the same language. Weighing or tying down operating levers for scrap balling machines should be absolutely forbidden. Particular attention must be directed to the operation of scrap shears. When not in use they should always be shut down. Only experienced or thoroughly instructed scrap shear men should be allowed to operate alligator shears. The foreman should definitely instruct his men and allow only men on this job who are safe workers.

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IT is particularly important that only the regular run of mill scrap should be allowed to be cut on the shears except where special permission has been otherwise granted. Tool steel must never be cut on shears. In operating the shears men should work at a safe distance so their hands will not be caught between the guards and the material being cut. When one man is passing the end of binding wire to the bundle or doing any other work close to the machine the other man must keep away from the starting device. Operators should stand at a safe distance from the machine when feeding scrap.

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THE hands should never be used to guide scrap into the machine. Hooks provided for this purpose must be used, and care exercised at all times that the operator does not allow his feet to become entangled in the rod. The operator should also be on guard for flying ends when the scrap baller is in operation. Goggles should of course be worn during this operation. It is also advisable that heavy soled shoes be worn to prevent injuries to the feet. Loose, oily, greasy or ragged clothing should never be worn on this job.

(*Please turn to page 131*)

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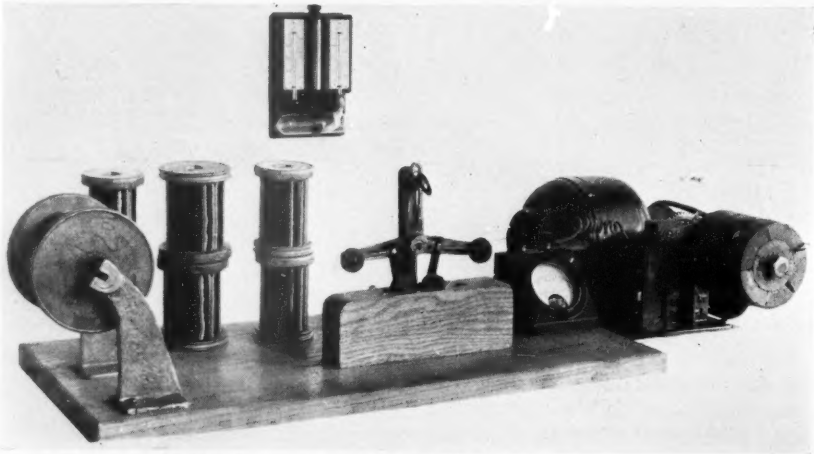

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Suitable Speeds For Nail Tumblers

By Kenneth B. Lewis
Wire Mill Engineer, Worcester, Mass.

A Mathematical Study for the Determination of the Correct Speed of Nail Tumblers—Discussion is Invited on this subject. Letters should be addressed to the Editor.

A MEMBER recently sent in a question to the secretary of the Wire Association regarding suitable speeds for nail tumblers and among the replies was one which suggested this as a topic for discussion at our next technical session. Unless such a discussion is to take the form of statements from various members as to their practice, valuable, no doubt, but not likely to stimulate much discussion, it ought to be preceded either by records of experimental work leading to definite conclusions or by an exposition of some natural laws believed to govern the matter. I do not recall ever having seen nail tumblers arranged for variable speed, and suspect that speeds are fixed wholly on the basis of practice known to be adequate. The wire industry is so full of odd details left to chance that it is entirely possible this point has never been studied. In the hope of building up some ground on which an argument or an experiment could be based, I have made some mathematical studies and submit them herewith.

Speed Determination

IT is agreed that very low speeds are unsatisfactory, and that there is also an upper critical speed at which cleaning becomes very poor. The upper speed ought to be easily determined for it clearly depends on the laws of centrifugal force. At a certain speed a layer of nails will cling to the shell of the tumbler without relative motion. What is this speed?

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WHEN a weight swings around a pivot it exerts a force F on the cord which connects it to that pivot, equal to $.000341WRN^2$ where W is its weight, R is the radius and N^2 the revolutions per minute. If a nail is to barely cling to the shell as it passes the highest point, the force F will just equal the weight W. Substitute the figure 1 for both these factors, for instance call the weight of the nail one ounce. The formula becomes $1=.000341RN^2$ and can be rewritten $RN^2=\frac{1}{.000341}$ or $RN=2932$.

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IN other words the radius of the barrel multiplied by the square of the R. P. M. must equal 2932 in order to make the nails stick to the shell all the way around. If the product is less than 2932 the nails will fall off and the lower the product the lower the spot on the shell wall where they will let go. To get this into real figures, take a 3 ft. barrel. Its radius is $1\frac{1}{2}$ ft. and since $1\frac{1}{2}N^2=2932$, $N^2=\frac{2932}{1.5}$, or 1954, and N=44RPM. A 3 ft. barrel must go slower than 44 or it won't clean nails. I have checked one unusually fast job and find it just gets under the wire on this formula.

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The Spot, The Speed and Path of The Nail

NOW it is interesting and perhaps profitable to see what mathematics will do to a nail after

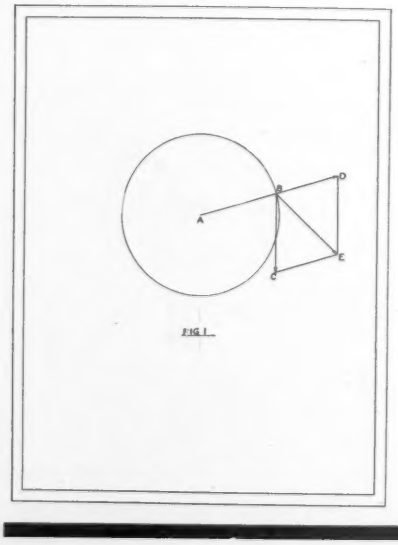

FIG 1.

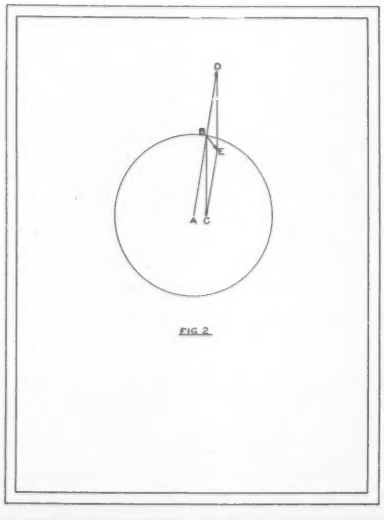

FIG 2.

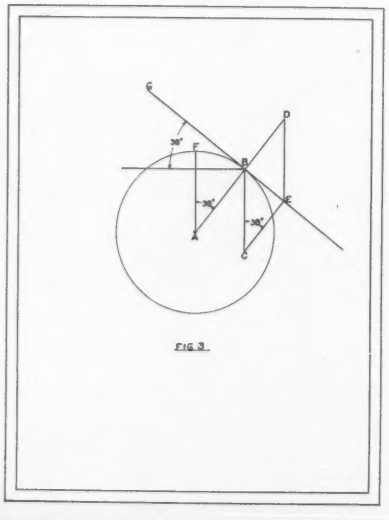

FIG 3.

it drops off the shell. Let us first pick the conditions under which we want it to drop, and see if we can figure the spot, the speed, and then the path of the nail.

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LET us assume we want to impress on the nail by centrifugal action a force equal to 78% of its weight, or, for the 1 ounce nail a force of .78 ounces. The basic formula becomes $.78 = .000341 RN^2$ or $RN^2 = \frac{.78}{.000341}$ or $RN^2 = 2290$. Then if the barrel is 3 ft. in diameter its speed will be the square root of $\frac{2290}{1.5}$, or 39 R. P. M.

Now how far up the side will the nail cling? Let us try a couple of sighting shots. In fig. 1, representing a 3 ft. barrel draw the radius A B a little above the horizontal. Assume in the diagram that is to be constructed that the line A B represents a force of one ounce. The nail is at B. Gravity is pulling it down with a force of one ounce, which we represent by the vertical line B C, length of of which is the same as the radius.

✦ ✦ ✦

CENTRIFUGAL force is trying to push the nail out along the radius. Prolong the radius a distance 78 hundredths of the length of the radius, for we have chosen this .78 ounce value as what we want impressed on the nail by its motion. This gives us a line B D. Complete the parallelogram C B D E and by the laws of mechanics if B D and B C are drawn to scale and represent forces acting in the directions indicated by the arrow heads, the resultant force will have the value and direction B E. Clearly if a nail at B is straining in the direction B E with the force indicated by the length of that line, it will press hard against the shell and stick there.

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NOW consider figure 2. Here we assume the nail has stuck till it is pretty near the top. We use the same letters and the same values for the sides of the parallelogram of forces. But look at the diagonal resultant. It shows that gravity is pulling the nail down harder than centrifugal force can hold it up. The resultant line shows the nail not pressing against the shell but leaving it. We have gone too far. In the first case our nail is pressing against the shell—in the second it can't make the grade. Clearly we must find a spot at which the nail is barely held, that is, the force impressed on it and its weight have a resultant that barely holds it. This will be the point where the resultant is a tangent to the circle, that is, leads neither into it nor out of it.

✦ ✦ ✦

SHIFT to figure 3. A radius and a tangent meet at a right angle, so the two triangles into which the parallelogram is divided by the resultant line are right triangles and Pythagoras has given us a lead. We subtract from the square of 1 the square of .78, take the square root of the answer and find that the length of the diagonal is .624. Since this is about the size of 38° (excuse me for dragging in trigonometry but it can't be helped) the small angles of the figure are 38° and so is the angle A B F and we spot the point where the nail falls at 38° from the top of the barrel.

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I NEED not tell the members of this association that when the nail lets go it doesn't merely drop. It starts on a ride and there is a way to chart its path up to the point where it hits something. When the nail reaches point B and

(*Please turn to page 133*)

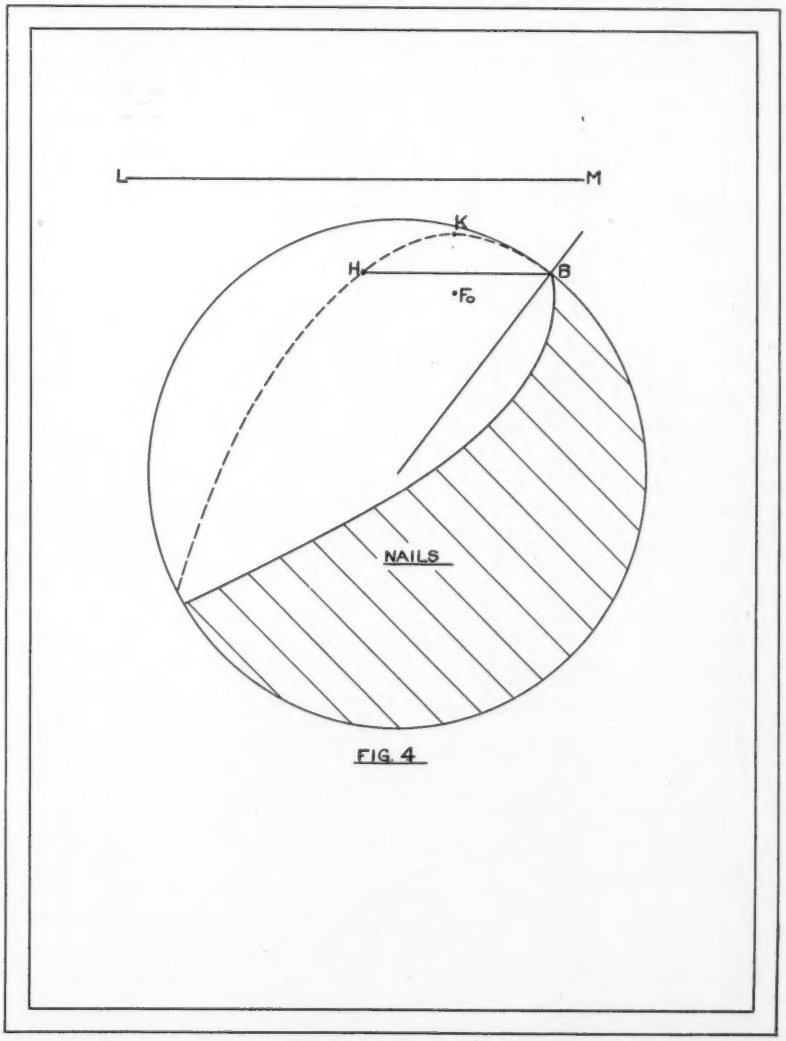

FIG. 4

Wire Questions and Answers

Question No. 1200-Speed of Nail Tumblers

The Wire Association:

We are writing you to inquire if you could obtain for us, information in regard to speed of nail tumblers. We would like to know in detail what the speed is at which three or four of the mills in the United States are operating their nail tumblers and the diameter of the tumblers, as, no doubt, the feet per minute is a factor and this can only be determined by having the speed and the outside diameter. In our Sydney plant we have what we consider a thirty keg nail tumbler, being 3'3" in diameter and 4' long. I wonder if any of your friends or associates in the nail business could give us their opinion as to what they would consider an efficient speed of the size of the tumbler referred to.

✦ ✦ ✦

Answer No. 1

The Wire Association:

In reply to your letter of the 5th, would advise that our 25 keg nail tumblers have a speed of 32 R. P. M. The O. D. of the same is 48" and the length inside is 68".

✦ ✦ ✦

Answer No. 2

The Wire Association:

Our tumblers are about the same size as the inquirers', being 54" long, 36" diameter, and we find the best speed to be 36 R. P. M.

✦ ✦ ✦

Answer No. 3

The Wire Association:

This is in reply to your recent inquiry from a member about nail tumblers. Three large producers run about as follows:

Diameter	R. P. M.
34	30
36	25 to 35
40	37

Two of these remark on the existence of two critical speeds, lower and upper. At a very low speed the nails would of course slide over very slowly as soon as the slope exceeded the angle of repose. There would be no falling effect. At higher speeds the nails would cling to the side, for friction would increase with pressure due to centrifugal force and the nail would be well up the side before its weight began to oppose this force and therefore decrease the friction.

At a suitable speed the nail might get three quarters of the way to the top. As its weight finally exceeded centrifugal force it would leave the side of the tumbler, but with inertia tending to throw it off at a tangent and gravity pulling it downward the resultant would cause it to leave the side with a parabolic path and strike the opposite wall somewhat lower down. I think it is this throwing effect that hurries up the job, as at gliding speeds you get very slow action.

At a high speed centrifugal force would hold the nails quiet against the shell and there would be absolutely no cleaning effect. I have worked out a formula which indicates that with R= radius (maximum) and N= R. P. M. RN^2 must be below 2940. You will note that the above figures are all below, being in fact 1540, 1112 to 2200 and 2700. The size of nail makes no difference.

There is a good deal depending on the extent to which the tumbler is filled. Within reasonable limits the speed of cleaning increases as the load is decreased, in nearly exact proportion. If the tumbler is too full the nail doesn't get a good flight.

✦ ✦ ✦

Answer No. 4

The Wire Association:

Referring to your letter of February 5th would say that nail tumblers are used at quite a number of different speeds. The average for the size mentioned as from 33 to 38 R. P. M. and should never be over 4/5 full.

✦ ✦ ✦

Answer No. 5

The Wire Association:

In regard to nail tumblers, the inquirer does not state the nature of his trouble, and therefore, makes it rather difficult to answer or properly give him the information he desires. Without this, however, I will say that if he is tumbling thirty kegs of nails in a three foot three diameter by four foot long rumbler, he is overloading same. We have never experienced any cleaning trouble of any kind here, except in very rare cases and in each case, we have been able to trace this trouble back to the steel, usually having been burnt in process, or over cleaned.

Our tumblers run forty R. P. M. per minute; have an inside diameter of thirty inches, and a length of thirty-six inches, and we clean on an average of twelve kegs per tumbler, with an average cleaning cycle of about two and one half hours. You can easily see from the dimensions of our tumblers that we do not load them any where near in proportion to the Sydney member. He will also find just slightly damp sawdust quite a help to him in cleaning.

✦ ✦ ✦

Answer No. 6

The Wire Association:

Our large tumbling barrels are hexagonal in shape. The diameter is 34 inches across the flat and rotate 30 R. P. M. The small ones are octagonal and measure 28 inches with a speed of 26 R. P. M. We are having good results with these speeds.

I do, however, know that there are two critical zones in the speed of tumbling barrels. If too slow or too fast, good results will not be obtained.

✦ ✦ ✦

Answer No. 7

The Wire Association:

Referring to your inquiry regarding tumbler speed, as far as I know the speed of 25 to 30 kegs tumblers in general use is from 25 to 35 R. P. M.

✦ ✦ ✦

Answer No. 8

The Wire Association:

The nail tumblers used in our plant are 36" in diameter and approximately 5' long. We operate them at a speed of thirty-four (34) revolutions per minute and they are what we term 20-keg rattlers. The exact number of 100# kegs of nails which they will satisfactorily handle varies with the size of nail. We go as high as 30 kegs on smaller nails and down to 12 kegs of larger nails in a batch. I would imagine that before the most satisfactory speed can be arrived at, it might be necessary for your inquirer to try various speeds and perhaps try various quantities of nails in a batch.

✦ ✦ ✦

Answer No. 9

See article on page 120 by K. B. Lewis on Speed of Nail Tumblers.

✦ ✦ ✦

Question No. 1200a - Composition of Acid Resisting Metal

The Wire Association:

We would like to have some information in regard to the composition of acid resisting metal for use in making hairpin hooks for wire mill cleaning house, using 58° to 66° Sulphuric Acid. Of course, our shops are in a position to manufacture these hair-pin hooks and if you can obtain for us the most satisfactory analysis, it would be greatly appreciated.

✦ ✦ ✦

Answer No. 1

The Wire Association:

The hooks we use in our wire mill cleaning house are of Anti-Acid Metal, made by the Wheeling Bronze Casting Company, Wheeling, W. Va., and is known as B & M Metal. We do not have the analysis of the same.

✦ ✦ ✦

Answer No. 2

The Wire Association:

Regarding acid proof metal, the Y. S. & T. Co., the Bourne Fuller Co., and Sheffield Steel Corp., all get their hook castings from Extruded Metal Products Co., of Martin's Ferry, W. Va.

The metal is lighter than other copper bearings alloys and doubtless contains

Wire Questions and Answers

some aluminum. It costs in cast form about 30 cents a pound, and has a tensile strength of 60,000. It is quite likely that an inquiry from a consumer would bring forth information about the analysis but I suspect the alloy is one in which the melting and casting technique are as important as composition.

✦ ✦ ✦

Answer No. 3

The Wire Association:

In regard to acid resisting metal using 58° to 66° sulphuric acid, would say that this is generally used in from 3 to 3½% solution. For this purpose there are several metals on the market. One of the best known to-day is "Resistac" made by the American Manganese Bronze Company, Holmesburg, Philadelphia, Pa.

For ordinary brass foundry production, the following are used, one known as "High Lead Phosphor Bronze" and is made from

Copper	.85%
Tin	.07
Zinc	.05
Lead	.03

Another used quite a bit is

Copper	.88%
Tin	.06
Lead	.06

✦ ✦ ✦

Answer No. 4

The Wire Association:

In regard to acid resisting metal hair pin hook for the cleaning department, must say that I am unable to answer this, since we have never used hair pin hooks, always preferring to use what is generally known as yoke sticks, 3 by 5 inch Elm Lumber and at a length depending upon the number of coils to be cleaned or the size of his acid tank. We use ordinary cast iron for hangers for these sticks to lay in, and in case he is interested, I would be glad to send him a pencil sketch of our arrangement.

✦ ✦ ✦

Answer No. 5

The Wire Association:

Replying to your inquiry under date of February 5th, we beg to suggest the following analysis which is giving us very good results as an acid proof metal:

Copper	81%
Tin	8%
Lead	10%
Nickel	1%

✦ ✦ ✦

Answer No. 6

The Wire Association:

In reply to your recent letter, the material which we use for yokes for cleaning cranes is known as Aluminum bronze and has an approximate composition of 89 per cent copper, 10 per cent aluminum and 1 per cent iron.

✦ ✦ ✦

Answer No. 7

The Wire Association:

Analysis for acid resisting hairpin hooks is as follows:

Copper	88%
Tin	10%
Lead	2%

The Wire Association is for the specific purpose of improving production methods. It was organized as a clearing house of ideas on technical problems and research work in all phases of practical wire drawing and wire working.

The following inquiries were received from and answered by members of the Wire Association. These inquiries are sent to the Secretary of the Association who acts as a central clearing point, and neither the names of the firms or individuals sending in the inquiry, or of the men or firms replying are divulged without permission.

Join the Wire Association!

Question No. 1214--Bright Wire Drawn One Hole From The Rod

"We are experiencing some difficulty in producing a bright clean wire drawn one hole from the rod. Will you ask for information for us as to the preparation of rods and the lubricant used in drawing this wire to produce a bright surface and clean enough to weld and galvanize easily?"

✦ ✦ ✦

Answer No. 1

"Referring to your letter regarding producing bright clean wire drawn one hole from rod. The only way I know that this might be done, is to clean the rod and use a very light lime and draw the wire through a very soft grease. Most of the people who are doing this work draw it two holes from the rod."

✦ ✦ ✦

Answer No. 2

"Your request for information in regard to producing bright clean wire in one pass from rod, has been received.

This is being done in some mills, but in most mills they are making two passes. In one mill that we know of they are making .218" spoke wire from #5 rod in one pass and are getting good tonnage through the dies and clean wire. You must remember that to produce clean bright wire through a die you are using a die to clean the wire and naturally this operation costs money in reduced die life.

The only mill that I know of who is getting a clean spoke wire in one pass from the rod is using as a lubricant a mixture of beef tallow, Ivory soap powder, and lime water skimmed from the surface of the lime tank. These ingredients are mixed so that the so-called lubricant has a consistency of paste. The rod is cleaned and has a light lime coat."

✦ ✦ ✦

Question No. 1217--Spiral Wrapping of Hay Ties

"Some of the companies are wrapping hay ties spirally, that is, instead of the old fashioned wrap they are wrapping the bundle of 250 ties with a spiral wrap. Do you know where they are getting these machines?"

✦ ✦ ✦

Answer No. 7

"Some people have built machines for this purpose, but they are not necessary. The spiral wrap can be put on in a very cheap and simple way without rotating the bundle of ties. The trick is absurdly simple, but is hard to put on paper. If this member is willing to give his name, I will doubtless run into him somewhere before long and explain the trick." (Name sent to inquirer.)

✦ ✦ ✦

Answer No. 2

"I have had developed for some years the spiral wrapping of Bale Tie bundles, and can either demonstrate a manual method of doing this as rapidly and cheaply as the common hand tie, or furnish machinery for machine tying with a spiral wrap." (Name sent to quirer.)

✦ ✦ ✦

Answer No. 3

"Referring to your letter of January 30th regarding the wrapping of bale ties. Please be advised that we are wrapping our ties by this method and there may be a few other companies doing the same thing. The machine we are using, we built ourselves. However, we would suggest that you advise your client to get in touch with the Terkelsen Machine Company, Terkelsen Building, 326 A Street, Boston, Mass."

✦ ✦ ✦

Information is Wanted on The Questions Following Question No. 1201

"We are having difficulty in avoiding the oxidization loss of calcium when mixed into moulten lead for cable sheathing purposes. We have tried to prevent this by placing charcoal powder on the surface, but have been unsuccessful.

We would greatly appreciate having whatever comments any members of the Wire Association may make."

✦ ✦ ✦

Question No. 1202

"Can you find out whether any mill has been making an aluminum bronze mixture in rod or wire rod that would cover an analysis within the range below:

Copper 91% to 98½%
Aluminum ½% to 4%
Tin 1% to 5%

A Review of Recent Wire Patents

No. 1,840,282, INSULATED ELECTRICAL CONDUCTOR, Patented January 5, 1932, by Herbert O. Anderson, of New Haven, Connecticut, Assignor to Rockbestos Products Corporation, of New Haven, Connecticut.

A double layer of varnished cambric is placed about the wire conductor and these layers covered by asbestos fibre, pressed into a compact mass.

✦ ✦ ✦

No. 1,841,348, ELECTRICAL CONDUCTOR, Patented January 12, 1932, by Charles Wills Abbott, of Hartford, Connecticut, Assignor, by Mesne Assignments, to General Cable Company, of New York, N. Y., a Corporation of New Jersey.

The insulated wire conductors are treated with a fire and moisture proof compound containing zinc oxide and water glass.

✦ ✦ ✦

No. 1,841,486, COMPOSITE METALLIC STRAND, Patented January 19, 1932, by Victor E. Legg, of Maplewood, New Jersey, Assignor to Bell Telephone Laboratories, Inc., of New York, N. Y., a Corporation of New York.

The inventor uses as a separator, either wood pulp and ammonium nitrate, or a fiborous thread, such as cotton, impregnated with ammonium nitrate. This material is employed where the loading material requires a heat treatment after being applied to the wire conductors.

✦ ✦ ✦

No. 1,842,439, CUSHION SPRING CONSTRUCTION, Patented January 26, 1932, by Abram C. Wisner, of Jackson, Michigan, Assigner to Reynolds Spring Company, of Jackson, Michigan, a Corporation of Michigan.

In this construction, flat coil springs are inserted between the tops of the elongated helidal springs, the flat springs being of such a size as to lie tangent to the tops of the other springs forming a given space and are secured to the elongated springs at the points of tangency.

✦ ✦ ✦

No. 1,842,554, WIRE FEEDING DEVICE, Patented January 26, 1932, by Wilfred B. Mathewson, of Weymouth, Massachusetts, Assignor to American Window Shade Machine Company, Inc., of Boston, Massachusetts, a Corporation of Massachusetts.

The device is used in connection with a staple-making machine, for instance, and the particular device comprises a rotary wire-feeding member which rotates about an axis parallel to the direction in which the wire is fed, this member having a spirally-arranged blade on its periphery which engages the wire and feeds it forward. This is a division of the application filed by the inventor January 25, 1928, Serial No. 249,281, which matured into Patent No. 1,762,450, dated June 10, 1930.

✦ ✦ ✦

No. 1,839,321, REELING DEVICE, Patented January 5, 1932, by Robert J. Kent, of Jamaica, New York, Assignor to American Telephone & Telegraph Company, a Corporation of New York.

A collapsible reel is provided for the winding and unwinding of coils of wire, the unreeling action being stopped upon stoppage of pulling upon the wire.

Complete Descriptions and Drawings of Patents May Be Had for 25 cents. Address, Wire & Wire Products, 551 Fifth Avenue, New York.

✦ ✦ ✦

No. 1,834,733, WIRE BENDING MACHINE, Patented Dec. 1, 1931, by Lora E. Poole, of Anderson, Indiana, Assignor to Delco-Remy Corporation, of Anderson, Indiana, a Corporation of Delaware.

The machine is particularly adapted for the manufacture of single bar conductors for electric motors, commonly known as hairpin conductors. An object of the invention is to provide mechanism for bending the intermediate portion of the strip of wire in one plane in order to produce the desired configuration of the hairpin yoke, the improvements being to obtain a construction whereby the bending dies will wear out less rapidly.

✦ ✦ ✦

No. 1,844,579, WIRE STRAIGHTENER, Patented February 9, 1932, by Charles D. Johnson, of Worcester, Massachusetts, Assignor to Johnson Steel & Wire Company, Inc., a Corporation of Massachusetts.

In accordance with this invention, which covers a rotary wire straightener, each sleeve carrying the wire-bending blocks, is driven from a rotary motor of a suitable type, which is mounted directly on the sleeve instead of being driven through belts, gears or the like, as is customary.

✦ ✦ ✦

No. 1,844,699, WIRE DRAWING APPARATUS, Patented February 9, 1932, by George E. Stack, of Ballstoh, Spa, New York, Assignor to General Electric Company, a Corporation of New York.

More particularly, this invention relates to control devices for controlling the operation of translating devices, such as electric motors, employed to drive the reeling drums of wire drawing machines and the like, and has for its object the provision of a device for maintaining the tension of the wire substantially constant during the drawing process.

✦ ✦ ✦

No. 1,845,041, INSULATED ELECTRIC CONDUCTOR, Patented February 16, 1932, by Henrik Boving, of New York, N. Y., Assignor to Bell Telephone Laboratories, Incorporated, of New York, N. Y., a Corporation of New York.

Particularly, this invention relates to the coating or insulation (enamel) for wire conductors, the inventor providing a method whereby the inner coating of the wire will become non-adherent upon the application of heat, but the outer coating will adhere to the inner coating.

✦ ✦ ✦

No. 1,845,303, NAIL DISTRIBUTOR, Patented February 16, 1932, by Thomas Lund, of Beverly, Massachusetts, Assignor to United Shoe Machinery Corporation, of Paterson, New Jersey, a Corporation of New Jersey.

An object of the invention is to confine the nails being distributed in a drum system of distribution to the desired paths, this being accomplished by the provision of a guard-plate for the drum opening or openings for one or more conveyors, this plate being arranged in a close proximity to the drum-wall about the opening therein and so mounted as to permit its adjustment towards and from the drum.

✦ ✦ ✦

No. 1,845,651, NAIL FEEDING MECHANISM, Patented February 16, 1932, by William C. Dickson, of Evanston, Illinois.

The primary object of the invention is to provide means associated with the bottom of the end of the nail supporting plate for discharging but a single nail at a time from each slot in the plate, and to so dispose the elements of this means as to first isolate the nail to be discharged from the others before it is discharged, so that no entanglement can take place and the discharged nail drops point downward into the conduit.

✦ ✦ ✦

No. 1,846,370, SPRING STRUCTURE, Patented February 23, 1932, by George A. Stackhouse, of Oakland, California, Assignor to L. A. Young Spring and Wire Corporation, of Detroit, Michigan.

The invention relates to spirally coiled body springs, disposed in rows with an offset, of substantial length and straight, from the top coils. A helically coiled spring cross member connect these offsets as well as the laterally disposed terminals.

✦ ✦ ✦

No. 1,846,497, SCREW MACHINE, Patented February 23, 1932, by Charles A. Rich, of Providence, Rhode Island, Assignor to Brown and Sharpe Manufacturing Company, a Corporation of Rhode Island.

It is an object of the invention to provide means adapted for use in classes of work where a portion of the leading end of the stock bar is reduced in diameter prior to each cutting-off operation, which will act to automatically limit advance of the shouldered portion of the bar.

✦ ✦ ✦

No. 1,846,599, OILPROOFED ELECTRICAL CONDUIT, INSULATION, ETC., Patented February 23, 1932, by Joseph A. Kennedy, of Pawtucket, Rhode Island, Assignor, by Mesne Assignments, to Anaconda Wire and Cable Company, a Corporation of Delaware.

The invention relates to the covering for the wire conductor and includes a flame-proof coat, an outer oil-proofing coat, and an intermediate homogeneous coat of a substance which is insoluble by the solvents of the flame-proof and oil-proofing coats. This substance may be sodium silicate in aqueous solution.

'Round the World With the Wire Industry

Steel Cartels for France and Italy

IT has just been announced that an understanding on cartel lines has been reached by the concerns in the French steel industry. The object of the agreement, which is the first of its kind, is to place production on a quota basis. The quota of each producer is to be fixed by a committee consisting of three arbitrators, on the basis of the average production of the years 1929 and 1930. This agreement between the steel producers removes any obstacles to the renewal of the other sales offices in the French iron and steel industry. The sales offices are to be renewed on April 1 for a period of three years.

✦ ✦ ✦

IT is also announced that a cartel covering the greater part of the Italian iron and steel industry is to be formed in accordance with a recently issued Government decree. Certain works are to be reorganized, while others will probably be closed down. As from April 1 a sales office will commence to function for a period provisionally fixed at three years.

The wire industry is included within the scope of both these plans.

✦ ✦ ✦

Wire Rod Cartel Announces New Prices

THE Continental Wire Rod Cartel announces the issue of new c. i. f. prices for all the principal export markets, those for the United Kingdom being in pounds, those for the United States and China in dollars, and those for all other markets being in French francs. The new prices vary greatly according to whether wire rods are produced in the respective markets or not. Business with Britain at the official price of £5 15s. ($28.75 at par) is, however, practically impossible, as the fall in the pound has made British wire rods substantially cheaper than their continental competitors.

The wire interests are now paying scant attention to the negotiaions for reorganizing the Continental Steel Cartel, as the opposition of the Belgians is apparently too great.

✦ ✦ ✦

IWECO Extras For Wire Products

THE IWECO has issued new extras for wire products, per following list. The exras for packing have also been revised and now S (gold) 17/6 is charged for kegs and S 22/6 for cases and packets included. The extras have not only been adopted by the members of the IWECO but also by the Polish, Swiss and Italian industry, so that with the exception of the British, the whole European wire industry is now selling at these prices. Compared with the extras ruling in 1931 the prices are approximately 6-8% lower.

✦ ✦ ✦

Extras for Wires

In Gold Shillings Per Ton of 1016 Kilos

BWG	bright wire	galv. wire
3	5	10/
4–8	.....	.....
9	5	5/
10	7/6	10/
11	10/	15/
12	12/6	20/
12½	15/	22/6
13	15	25/
13½	17/6	30/
14	20/	35/
15	25/	45/
15½	30/	47/6
16	32/6	50/
17	45/–	60/
17½	50/	70/
18	55/–	85/–
18½	60/	100/
19	70/	110/
20	80/	125/
21	90/	135/
21½	100/	145/
22	110/	160/
22½	120/	175/
23	130/	190/
24	150/	210/
25	175/	250/

BWG	bright	galvaz'd
26	200/	300/
27	230/	340/
28	260/	390/
29	300/	440/
30	340/	490/
31	370/	550/

Square wire	5/–
Hollow drill wire	s 15/
Oval wire	5/–
Oval wire galvanized	7/6
Oval nail wire	20/
Black annealed	10/
Coppered	30/
Polished	20/
S. M. quality	5/
Rivet or bolt wire	30/
Half hard, half soft	30/
Key wire	30/
Hair pin wire	20/
Telegraph/Telephone wire	10/
Wire for staple manufacture (Galvanized)	30/
Extra greased wire	5/

✦ ✦ ✦

Wood Screws From Germany

GERMANY has hitherto exported almost no wood screws to the U. S. A. Some makers however have recognized the possibilities offered there and will probably open a sales office at New York and San Francisco.

✦ ✦ ✦

THE negotiations between the IWECO and the Austrian and the Hungarian wire industry have been ended. It is probable that next month both countries will be accepted as members, which would further strengthen the position of the IWECO. The Austrian industry is mainly competing in wire netting and mesh and the Hungarian in wire nails.

✦ ✦ ✦

The British Summary of the Wire Galvanizing Discussion Will Be Published in the May Issue of Wire and Wire Products

Exports and Imports of Wire

Exports of iron and steel wire products in Dec., 1931 and Jan., 1932
(In gross tons)

	January 1932	December 1931	January 1931
Wire rods	1,108	2,162	3,249
Hoops, bands and strip steel	1,863	1,616	3,448
Plain Black or galvanized iron or steel wire	698	978	1,508
Barbed wire and woven wire fencing	1,478	1,630	2,767
Woven wire screen cloth	42	47	65
Wire rope	155	180	248
Insulated iron or steel wire and cable	12	22	65
Other wire and manufactures	187	340	395
Wire nails	1,202	1,161	978
Tacks	32	81	37
Other nails including staples	266	275	375
Bolts, machine screws, nuts, rivets and washers	225	284	505
Total, these 12 classifications	7,268	8,776	13,640

Imports of iron and steel wire and wire products into the United States
(In gross tons)

Concrete reinforcement and other bars	7,298	6,645	7,302
Wire rods	986	662	584
Barbed wire	1,325	1,675	629
Round iron and steel wire	147	118	174
Telephone and telegraph wire	2	3	6
Flat wire and strip steel	71	96	44
Wire rope and strand	139	165	156
Other wire	84	24	60
Hoops and bands	2,034	4,348	1,559
Nails, tacks and staples	800	335	538
Bolts, nuts and rivets	18	5	141
Total, these 11 classifications	12,904	14,076	11,193

EXPORTS of iron and steel products from the United States during January, 1932, was 16,603 tons less than in December. Imports, on the other hand, rose 5,241 tons above the December figure but still remained less than the November imports.

✦ ✦ ✦

BELGIUM lead in exports to the United States, its total including 3,085 tons of concrete bars and 2,463 tons of merchant bars. Among the German exports to the United States were 1,066 tons of merchant bars 731 tons of barbed wire and 769 tons of nails. French exports to the United States included 375 tons of hoops and bands.

✦ ✦ ✦

IMPORTS of card clothing declined to 2,200 square feet valued at $2,066 in January — 2,177 square feet ($2,021) coming from the United Kingdom and the rest from the Netherlands.

✦ ✦ ✦

WIRE cloth and screening imports rose to 18,763 square feet, with 9,226 square feet coming from Germany, 5,711 square feet from France, and 2,760 square feet from Canada.

THE Fourdrinier wire trade declined to only 90,158 square feet—50,965 square feet coming from Austria and 33,333 square feet from Germany.

✦ ✦ ✦

RECEIPTS of wire fencing and netting increased in January —that galvanized before weaving totaling 5,352,828 square feet and including 5,333,942 square feet from Germany (the rest from Belgium), while that galvanized after weaving totaled 6,155,828 square feet, and was had from Germany (2,750,628 square feet), the Netherlands (1,270,950 square feet), and Belgium (1,134,250 square feet).

✦ ✦ ✦

WIRE heddle imports doubled, to total 1,031,000 pieces—1,000,000 pieces coming from Switzerland and 31,000 pieces from Germany.

✦ ✦ ✦

WOOD-SCREW imports increased to 8,804 gross ($915), 8,790 gross ($902) coming from Sweden and the remainder from Germany.

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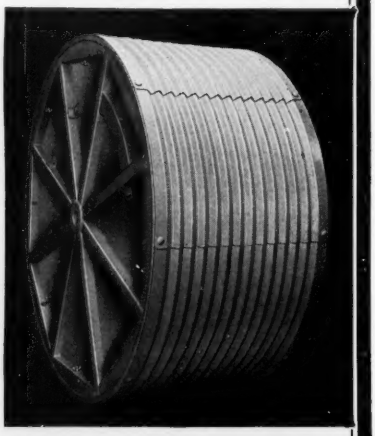

Manufactured and sold by
R. B. HAYWARD COMPANY
1714-1736 Sheffield Ave., Chicago

Under license arrangement with Electrical Research Products, Inc. Subsidiary of Western Electric Company, Incorporated.

Fourdrinier Cloth

(*Continued from page 110*)

wire fabrics of very different weave and number. The weaves described in Sec. I cover all paper making requirements.

✦ ✦ ✦

FOR the manufacture of the commonest grades, news-print, writing paper and book papers of ordinary grades the fabrics usd is the simple flat weave No. 70. This class accounts for 50% of the entire production.

✦ ✦ ✦

FOR stronger papers, as for example, wrapping paper of coarse fibre, the draining must be done with a coarse mesh; here the requirement is a simple flat fabric No. 65, 60 or 55. For still stronger wrapping paper for instance straw papers with still coarser fibres it would seem logical to use the simple flat weave in No. 45 or 50, but a difficulty arises. In weaving a fabric with coarser mesh one must use a heavier warp wire, but the stronger the fabric the less flexible it is, and the more it hardens when bent. The wires required for a 45 or 50 mesh fabric could be easily woven and would make a perfectly flat fabric but such wires are too coarse to stand the continual bending around rolls, which the Fourdrinier paper machine imposes on them. The warp wires would harden due to cold work and become brittle. For this job therefore the cable fabric is used, so that for the same diameter and strength the flexibility will be greater. The single cable weave is used, in which the filler wires are solid, since these wires are not subject to cold work in operation.

✦ ✦ ✦

WITH a cable fabric the size of mesh can be chosen to suit the job. With the coarser meshes, No. 25 and 28, used for the preparation of the wood pulp papers, when the belt is wide the filler wires must be made larger, and in this case double cable weave is used. Care must be taken to have these coarse cable fabrics especially resistant to chemicals. While bronze is pretty good in the presence of chemicals, it is consider-

Robertson Hydraulic Pumps

Apparently a massive and ponderous mechanism to be capable of operating 1000—2500-ton lead presses, yet built with the absolute precision of an airplane engine.

. . . That describes the Robertson new and improved Hydraulic Pump. Its quality and accuracy of workmanship are clearly evident even from the illustration. The design of this pump embodies everything we know about its especial requirements for lead encasing equipment. And we have been making lead-encasing presses and allied types of supplementary machinery for nearly three quarters of a century.

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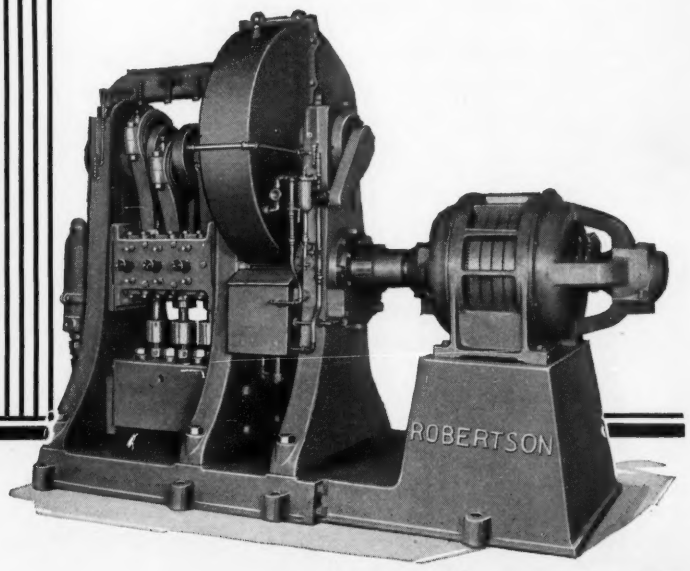
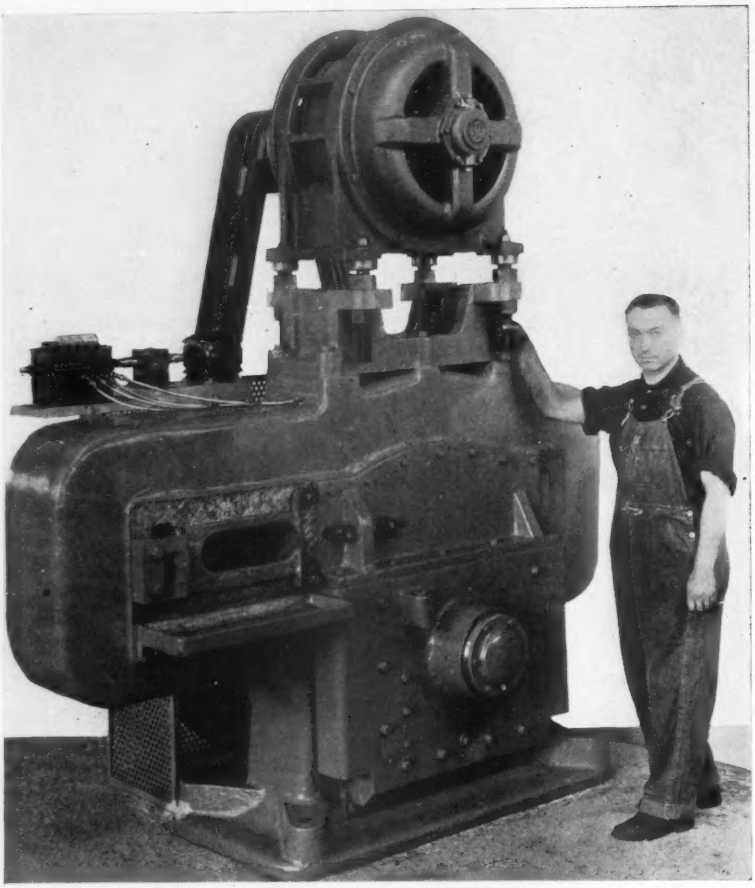


Rod, Wire, Cable, Strip and Tube Machinery



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Designer and Builder of Special Machinery
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ably better when tinned, or, better still, given a lead coat. Each individual wire must of course be separately coated before stranding.

✦ ✦ ✦

IN the manufacture of a fine fibred paper, or one with finer grain and better feel than newsprint, for instance photographic paper, proof paper, thin rag paper, etc., the proper fabric is the simple flat fabric with small mesh, 75, 80, 85 or even 95. For still finer paper however it is not practical to use a still finer mesh, since for this purpose finer warp and filler wires would have to be chosen, and the resulting fabric would have neither strength nor stiffness. A different weave must be used. A simple flat weave of 60 mesh gives a quick draining. In such a fabric each warp wire can be replaced with 3 finer wires close together, and a finer filler wire used. The meshes will then be somewhat narrower, and their length can also be diminished by closer weaving, since it is the diameter of the warp wire that limits the closeness of spacing of the filler wires. The heavy warp wires having been replaced with a triplet of fine wires can be woven closer without any difficulty. It is the use of these triple warp fabrics that makes possible the production of the finest papers. These fabrics have the following characteristics:

1. Larger number of meshes per unit surface, as compared with the simple flat fabrics.

2. Narrower and shorter meshes.

3. Substitution for the heavy "crowning" of the single warp of the slight crowning due to smaller wires.

✦ ✦ ✦

THE foregoing paragraph describes the substitution of triple warps for single warp. It is of course true that the double warp shares in a small way the advantages of the triple, and forms a link between it and the plain weave.

✦ ✦ ✦

WE have seen that the simple weave is replaced by cable weave for coarse work, while the triple warp is used for the finer grades. Both these weaves overlap to some extent the field of the

simple weave. Is there any advantage to be gained by the use of cable weave in cases where the simple weaves give sufficient drainage? That depends on the qualities required. If a fine finish is wanted the plain weave is preferable, for the cable weave, due to the structure of the cables, which are somewhat distorted in crowning, gives a less satisfactory finish; it roughens the surface slightly, which is perfectly all right for the coarse papers but not satisfactory for the finer grades.

✦ ✦ ✦

THE same question might be raised regarding the heavy triple weaves, and the answer is in the negative. On high speed paper machines the flexible triple warp fabric pulls harder than the plain weave. Although it has more meshes per unit the drying effect is not so great, as the meshes are smaller.

✦ ✦ ✦

STARTING with the plain flat weave which is simplest and oldest, the industry has developed the other weaves for special work. The accompanying table gives the types and numbers of weaves in common use. This table is much condensed and does not pretend to cover the field completely; it will serve merely as an outline. It is always to be remembered that the finer the mesh the slower the drainage, but that the fineness of the mesh is governed by these four conditions:

1. To favor the draining a fine fabric must be tightly stretched in the machine.

2. Fine weave reduces the strength of the fabric.

3. Fine weave necessitates a high degree of vacuum in the suction box, and so increases wear.

4. Fine mesh favors clogging of the fabrics, which is then endangered by frequent and drastic cleaning operations.

✦ ✦ ✦

Cylinder Fabrics

BESIDE fabric for the Fourdrinier machine the industry requires fabrics for the cylinder machines. For such service there

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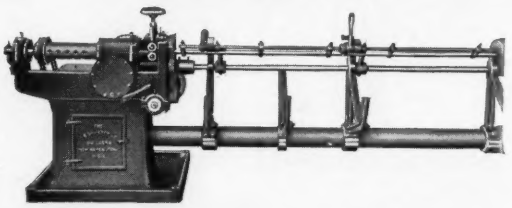

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SPECIAL MACHINERY

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44 Franklin St.

is used a simple flat weave, and here a coarse mesh can be used safely, for the warps do not work, but are made fast to their substructure. The mesh count runs between 45 and 70. This "draining" fabric is mounted upon a supporting fabric of 8 to 10 mesh, also simple weave whose wires instead of round are half-round in section. These half-round wires insure sufficient rigidity in a coarse mesh fabric; their crowns are not unduly high, and are well rounded where the finer fabric touches them, while the under side is quite flat and rests firmly on the cylinder.

Frequently two under-fabrics are used, an intermediate of simple flat weave, 16 to 20 mesh, and a foundation fabric of 6 to 8, or better, of triple warp No. 8. This last is called triple warp selvage weave, because of the size of the filler wires, which give a stiff selvage.

✦ ✦ ✦

WHEN the cylinder machine is used for filter paper and vellum laid weave is used. The chains and ladders of the fabric make transparent lines. The fine warp wires serve only to prevent the pulp from coming through between the ladders, and do not mark the paper.

Water marks are often impressed on these cylinder machines just as on the other type of machine.

✦ ✦ ✦

Draining Fabrics, Stock Tank Fabrics, Etc.

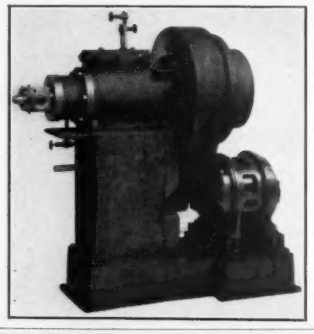
FOR these fabrics, which are always rigidly attached to frames, plain weave is generally used, in appropriate mesh. For fine work the twill weave is often used, its peculiar virtue being that for the same mesh size it can be woven of coarser wires than plain weave of the same mesh number.

✦ ✦ ✦

Basket Weaves

THESE weaves are used for the bottoms of tanks in which the half-processed pulp is stored, and also to give a special finish to certain fine grades of paper.

JOHNSON SUPER PRODUCTION TUBING & STRAINING MACHINE



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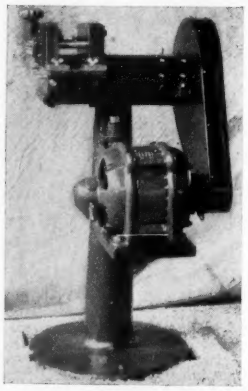

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CHICAGO OFFICE, 20 NORTH WACKER DRIVE

Safety Practices Increase Rod Mill Efficiency

(*Continued from page 117*)

Continuous Rod Mill

WE have considered in the foregoing account hazards which are largely peculiar to the looping type of rod mill. A large percentage of this country's wire rods are rolled on continuous mills. Some of the hazards discussed are common to both types of mill, some peculiar to the looping mill, and the continuous mill, while inherently free from many of the dangers discussed, has, on account of its high speed, hazards of its own.

✦ ✦ ✦

THE continuous mill almost invariably uses billets of such length and unit weight that hand piling is impossible. Such billets are usually wired together into convenient units for crane handling and their manipulation is subject only to the usual hazards of crane work. The high finishing speed of the continuous mill, 3500 to 4000 feet per minute, is far above the limit of human skill in manipulation, and has forced the manufacturers of such mills to resort to automatic appliances. The fact that the mill crew is less than one-half the crew required at the looping mill is in itself a large factor in reducing the accident rate. Problems of protecting the catcher and the hooker do not arise, since such loops as are provided for are established by mechanical "repeaters" and the groups of stands between which loops are formed are separately driven at such relative speeds that a loop once established does not grow appreciably in length. There are no men on the looping floor. The reels are located below floor and the rod passes to them from the finishing rolls in pipes. The reeling, switching, dumping and conveying of hot rod bundles is entirely mechanical, under the control of an operator in an elevated "pulpit".

✦ ✦ ✦

THE hazards of the continuous mill are those which are in-

MACHINES
FOR COATING WIRE
with
RUBBER, PLASTIC or FLUX
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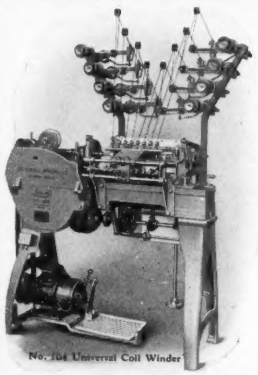
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Six other machine types complete a line of coil winders answering any possible manufacturing need.

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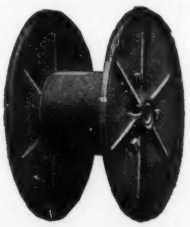

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Proven by test to lower costs and improve efficiency.
Manufactured exclusively for wire drawing by
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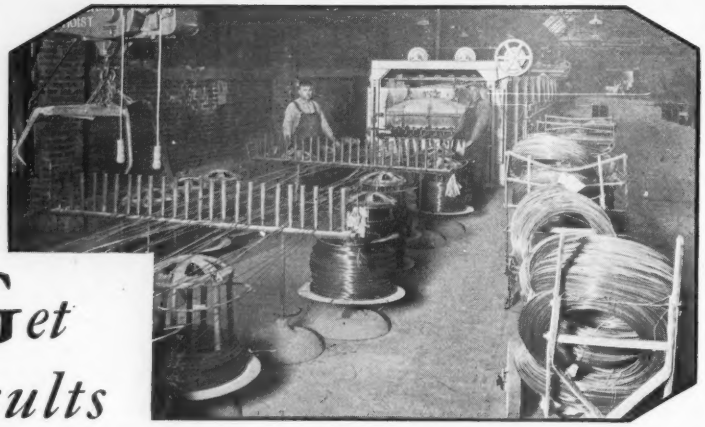
Wire drawing soap specialists since 1893.



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separable from the presence of steel at 2000° moving at 4000 feet a minute. The finishing trains where high speed makes a misdirected rod peculiarly dangerous are protected with cable screens. An operator of long experience can instantly detect any irregularity by a slight change in the pitch or note of the high speed machinery and it is common to see such a man turn his head instantly when a cobble starts, but in spite of this and of all possible safeguards, it remains an excellent rule never to turn your back fully on a rod mill.

✦ ✦ ✦

Conclusion

THERE is much which could be added to this article but only the high lights of safe operation have been considered. It will be noted that no mention has been made of the safe operation of gas producers or other such auxiliary equipment found in rod mill operation. These of course are subjects in themselves.

✦ ✦ ✦

IT is not difficult to prevent accidents and injuries to workers where safety is made a definite part of operation. It will be found that the safe way is the efficient way to carry on a particular job. Above all, intelligent supervision is absolutely essential in the prevention of accidents in any line of industrial activity. Good foremen know their men, know their jobs, and are in a position to not only maintain production, but to maintain production with safety. It is not always easy to be on the lookout for the hazards of the particular operation, but it is essential that men be thoroughly familiar with their work and recognize the dangers to be encountered.

✦ ✦ ✦

Broden Construction Co.

Wire Mill and Cold Rolling Equipment

10255 Harvard Ave.
CLEVELAND, OHIO

SPEEDS FOR NAIL TUMBLERS

(*Continued from page 121*)

comes away from the shell it has been moving fast in a circular path and its inertia would, in the absence of any other force, send it out to the left along the tangent B G. There is another force, gravity, tending to pull the nail straight down. We should plot the resultant of these two forces.

✦ ✦ ✦

THE nail is in exactly the situation of a shell fired from a gun with its muzzle elevated. It will rise a little, then fall, at the same time moving. to the left There are formulas covering the flight of projectiles and we can apply them. The muzzle velocity we have decided is 6.1 feet per second, this being the shell speed of a 3 ft. barrel at 39 R. P. M. The angle of elevation is 38°, and if this isn't clear, ask your boy when he comes home from High School, and he'll check. The formula for the horizontal distance travelled before our projectile gets back to the level from which it started is $dh = \frac{V^2 \sin 2A}{g}$ in which V= velocity in ft. per second, A= angle of elevation, and g= acceleration due to gravity, which is known to be 32 at sea level and pretty close to that even at Pueblo, Colorado. Solving this we find the horizontal distance to be 1.13 ft., or 13.6 inches. I will scale this off on a horizontal line from point B and call the new point H, using for the purpose fig. 4.

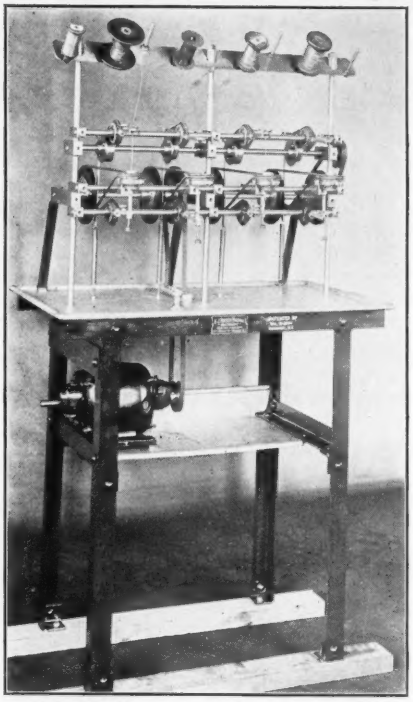
✦ ✦ ✦

NOW the formula for the highest point the projectile will reach is $dv = \frac{V^2 \sin^2 A}{2g}$. Solving this I find the high spot to be .216 ft., or 2.7 inches, which I will scale off and mark point K, directly above the center of line B H.

✦ ✦ ✦

THE path described by a projectile is a parabola, that curve whose peculiarity is that every point in it lies equally distant from a focus and from a base line called the directrix. The point I have

The Haddow Die Re-Cutting and Polishing Machine will lower your die re-cutting cost to a fraction of present costs



Why do you continue to pay a die cutter and pay for diamond dust to remove a large percentage of your diamond from your dies? Diamond that has done no work—when, by the use of the Haddow Die Recutting Machine you may use practically all your diamonds to draw wire, especially in the small sizes.

ONE MONTH'S SHOP PRODUCTION

Total number of dies cut —1047

Total number of hours required—182.5

Average number of dies per hour—5.73

Number of operators—1

With only one man—This machine will do the work now requiring four to six men in less time and at lower cost.

4 HEAD MACHINE—Also Made in 6-Head size (With 2 Heads for Heavier Dies).

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1870 1932
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Factories in France: Lagnieu-Cluses-Trevoux

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—As wire drawers for over 30 years, we know from *Experience* the particular shape of die for each material. We have found from this same experience that our special casting method of setting is best.

Why not let us quote on your diamond die requirements?
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HARRISON, N.J.
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marked K is called the vertex and there are rules by which, if the vertex and two points equally distant on the curve from the vertex are known, the focus and directrix can be located. I have done this, marking the focus Fo and the directrix L M, and have then completed and dotted in the rest of the parabola so far as it lies inside the barrel. This dotted line is the path of a nail under the conditions laid down.

✦ ✦ ✦

THE next question is, what do we want the nail to hit? Should it hit the shell a good rap, or is this likely to bend it, and would it be better to so load the barrel that the trailing edge of the mass of nails forms a cushion to soften the blow? If we want a clean hit on the shell the tumbler can be filled to a little over half its capacity. Now is the time for our operating members to come forward. I believe it is conceded that within certain limits the speed of cleaning will vary with the load, lighter loading giving a quicker cleaning in direct proportion. What are these limits, and is there in these figures any explanation?

WIRE DRAWING MACHINERY AND EQUIPMENT

Rod Frames—16" Frames, 8" Frames —Take-Up Frames, Wire Pointers—Puller Tongs.

General Castings for Wire Mill use.

Circulars on Request.

E. J. Scudder Foundry & Machine Co.
TRENTON, N. J.

✦ ✦ ✦

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The crane is a self-contained unit, consisting of a series of suction cups, mounted in a bracket suspended from a boom or bridge, or other crane construction. Vacuum is provided by a small motor-driven pump with air lines to the suction cups, the pump running continuously, and the vacuum control being a two-way valve which either applies the vacuum or lets the air in for release. Lifting power is determined by the size and number of vacuum cups.

It is held to be ideal for thin sheets, high-finish sheets, tin plate, chromium plated sheets, buffed copper sheets and polished stainless strips.

✦ ✦ ✦

Wire Drawing Diamond Dies

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Diamond, Composition and CHILLED IRON DIES
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BUYERS' GUIDE

For more complete information, consult the annual Directory, Index & Buyers' Guide.

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See Furnaces—Various Headings

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New England Butt Co., Providence, R. I.
John Robertson Co., Brooklyn, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

BAKERS
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Vaughn Machinery Co., Cuyahoga Falls, O.

BOBBINS
Mossberg Pressed Steel Co., Attleboro, Mass.

BRAIDER CARRIERS
Mossberg Pressed Steel Co., Attleboro, Mass.

CASTINGS—Wire Mill
E. J. Scudder Foundry & Machine Co., Trenton, N. J.

CLEANING & PICKLING EQUIPMENT
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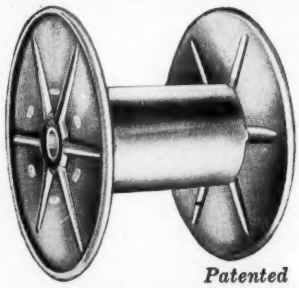
Fred'k M. Conran, Newark, N. J.
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

COILERS—Sheet and Wire
H. J. Ruesch Machine Co., Newark, N. J.

COMPOUNDS—Insulating
Corone Wire Insulators, Inc., Putnam, Conn.

COPHOLDERS
Mossberg Pressed Steel Corp., Attleboro, Mass.

CRANES—Wire Mill
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.



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DIES—Composition
Vianney Wire Die Works, New York, N. Y.

DIES—Diamond
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Cochaud Wire Die Co., New York.
Driver-Harris Co., Harrison, N. J.
Union Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York.
Waterbury Wire Die Co., Waterbury, Ct.

DIES—Lead Extrusion
John Robertson Co., Brooklyn, N. Y.

DIES—Repairs & Re-Cutting
Balloffet Diamond Wire Dies Co., Inc., N. Y. C.
Cochaud Wire Die Corp., New York.
Driver-Harris Co., Harrison, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.
William Haddow, Ossining, N. Y.
Vianney Wire Die Wks., N. Y.

DIES—Recutting and Repolishing Machine
Wm. Haddow, Ossining, N. Y.
Vianney Wire Die Works, New York, N. Y.

DIES—Rod and Tube Drawing
Carboloy Co., Inc., Newark, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.
Union Wire Die Corp., N. Y.
Vianney Wire Die Works, New York, N. Y.

DIES—Tantalum Carbide
Diamond Die Co. of America, New York, N. Y.
Vianney Wire Die Works, New York, N. Y.

DIES—Tungsten Carbide
Carboloy Co., Inc., Newark, N. J.
Driver-Harris Co., Harrison, N. J.
Union Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.

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Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

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Surface Combustion Co., Toledo, O.

FURNACES—Automatic
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Surface Combustion Co., Toledo, O.

FURNACES—Bright Annealing
W. S. Rockwell Co., New York, N. Y.
Surface Combustion Co., Toledo, O.

FURNACES—Electric
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Surface Combustion Co., Toledo, O.

FURNACES—Lead Melting
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FURNACES—Non-Oxidizing
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Surface Combustion Co., Toledo, O.

FURNACES—Wire
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Surface Combustion Co., Toledo, O.

GALVANIZING ENGINEER
W. H. Spowers, Jr., New York, N. Y.

INHIBITORS—
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Corone Wire Insulators, Inc., Putnam, Conn.

LATHES—Die Reaming
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

LIME—Pulverized
Amer. Lime & Stone Co., Bellefonte, Pa.

LUBRICANTS—Wire Drawing
R. H. Miller Co., Homer, N. Y.
J. T. Robertson Co., Syracuse, N. Y.

MACHINE—Die Re-cutting and Polishing
Wm. Haddow, Ossining, N. Y.

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American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
John Robertson Co., Brooklyn, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt. Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bunching
Amer. Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Electric
American Insulating Machinery Co., Philadelphia, Pa.
Fred'k M. Conran, Newark, N. J.
New England Butt Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Company, Paterson, N. J.

MACHINERY—Chain Making
Fred'k M. Conran, Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Closing
New England Butt Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Paper Insulated Coils
Universal Winding Co., Providence, R. I.

MACHINERY—Coil Winding
Amer. Insulating Mach'y Co., Phila., Pa.
Fred'k M. Conran, Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Universal Winding Co., Providence, R. I.

MACHINERY—Coilers
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Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
United Eng. & Fdy. Co., Pittsburgh, Pa.
Watson Machine Co., Paterson, N. J.

MACHINERY—Copper Wire Drawing and Rolling
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.
United Eng. & Fdy. Co., Pittsburgh, Pa.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cutting
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, O.
F. B. Shuster Co., New Haven, Conn.
Sleeper & Hartley, Worcester, Mass.
United Eng. & Fdy. Co., Pittsburgh, Pa.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Extruding
John Robertson Co., Brooklyn, N. Y.
John Royle & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Forming
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
Morgan Construction Co., Worcester, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Gang Winders
H. J. Ruesch Machine Co., Newark, N. J.
Watson Machine Co., Paterson, N. J.

BUYERS' GUIDE, Continued

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American Insulating Machinery Co., Phila.
Corone Wire Insulators, Inc., Putnam, Conn.
New England Butt Co., Providence, R. I.
John Royle & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lead Encasing Presses, etc.
John Robertson Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
John Robertson Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

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American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Measuring Wire & Cable
New England Butt. Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Panning
American Insulating Machinery Co., Phila.

MACHINERY—Pointing
Broden Construction Co., Cleveland, O.
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Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
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Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Rod
Broden Construction Co., Cleveland, O.
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Morgan Const. Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Rolling Mill
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Fred'k M. Conran, Newark, N. J.
Morgan Construction Co., Worcester, Mass.
H. L. Reusch Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.
United Eng. & Fdy. Co., Pittsburgh, Pa.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Rubber Strip Covering
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Corone Wire Insulators, Inc., Putnam, Conn.
John Royle & Sons, Paterson, N. J.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
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John Royle & Sons, Paterson, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Screw Wire
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
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Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
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Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

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MACHINERY—Staple
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H. J. Ruesch Machine Co., Newark, N. J.
F. B. Shuster, New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

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Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

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Broden Const. Co., Cleveland, O.
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H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.
United Eng. & Fdy. Co., Pittsburgh, Pa.

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Sleeper & Hartley, Worcester, Mass.

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Amer. Insulating Mach. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Company, Paterson, N. J.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Welding Wire
Micro Products Co., Peoria, Ill.
Vaughn Machinery Co., Cuyahoga Falls, O.
F. B. Shuster Co., New Haven, Conn.

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American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Universal Winding Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

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American Insulating Machinery Co., Phila.
Broden Const. Co., Cleveland, Ohio.
Fred'k M. Conran, Newark, N. J.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Manufacturing Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Watson Machine Company, Paterson, N. J.

PACKING—Metallic Fibre
Hudson Wire Co., Ossining, N. Y.

POTS—Lead Melting
John Robertson Co., Brooklyn, N. Y.

PRESSES—Lead Encasing
John Robertson Co., Brooklyn, N. Y.

PRESSES—Lead Extrusion
John Robertson Co., Brooklyn, N. Y.

PULLERS—Wire
E. J. Scudder Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
John Robertson Co., Brooklyn, N. Y.

REELS AND SPOOLS—All Kinds
R. B. Hayward Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
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REEL AND TENSION STAND—
Sleeper & Hartley Inc., Worcester, Mass.

REEL CRUTCHES
R. B. Hayward Co., Chicago, Ill.
Watson Machine Co., Paterson, N. J.

ROLLING MILLS—See Machinery—Rolling Mill

SOAPS—Wire Drawing
R. H. Miller Co., Homer, N. Y.
J. T. Robertson Co., Syracuse, N. Y.

SPOOLS—Annealing—Detachable Head Handling—Wire Stitching
Mossberg Pressed Steel Corp., Attleboro, Mass.

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TRUCKS
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

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Mossberg Pressed Steel Corp., Attleboro, Mass.

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Winsted Insulated Wire Co., Winsted, Conn.

WIRE—Nickel Silver and Phosphor Bronze
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.

WIRE—Various Kinds
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Seymour Mfg. Co., Seymour, Conn.
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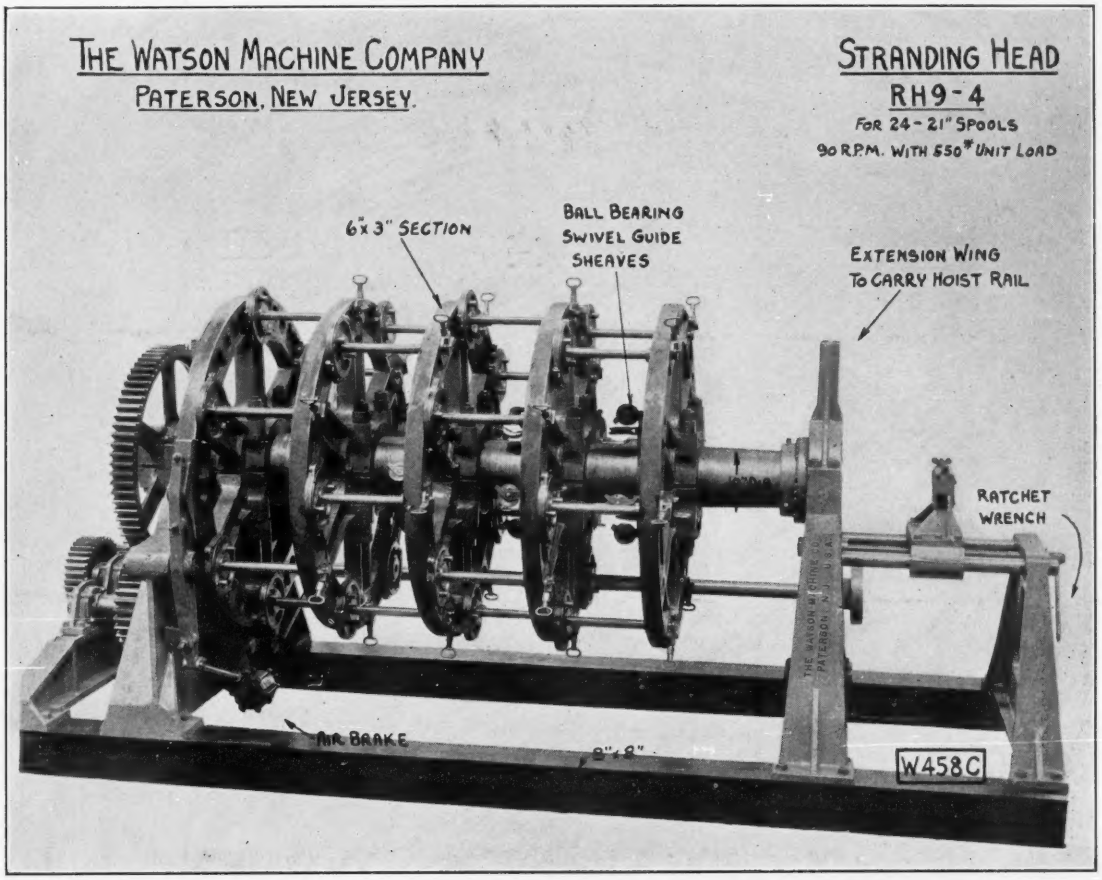
FOR THE STRANDING OF SOFT COPPER

Standard Designs for 100, 250 and 500 pound spools for 6, 12, 18, 24, 30 and 36-spool heads.



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Maintenance cost practically nil, due to absence of parts moving respective to Rotor Body.

Air Brakes—Rapid Tandem Threading through shaft bore—Ball Bearing Guide Sheaves—Rotor carried on Main Ball Bearings. All Roller Bearing Drive.

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**Name upon request.*

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